NORTHUMBERLAND SEA FISHERIES COMMITTEE.

REPORT on the Scientific Investigations

For the Year 1902.

EDITED BY ALEXANDER MEEK, M.Sc., F.Z.S.,

THE MARINE LABORATORY, CULLERCOATS, AND THE DURHAM COLLEGE OF SCIENCE, NEWCASTLE-UPON-TYNE.

Printed by order of the Committee, 16th October, 1902.

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SUMMARY AND GENERAL REPORT.

I have the honour of submitting the following Report on the scientific investigations for the year ending 16th October, 1902.

The season has been an extraordinarily successful one, especially with regard to such mid-water fishes as the herring, the mackerel, and the salmon. Trawlers have been catching, moreover, more ground fishes than usual, but the season was to them a detrimental one to some extent on account of the immense numbers of small haddocks which appeared to be distributed all over the North Sea. Our trawling experiments show that the ground fishes were present in most of the bays, also in unusually large numbers. The average catch for flat fishes was **turbot** 1, **sole** 21, **plaice** 165, **dabs** 121, **flounders** 5—total 317. The highest previous average was for **plaice** 130 in 1901, for **dabs** 96 in 1900, for **soles** 20 in 1893 and in 1894, and for the total **flat fishes** 231 in 1900. The results for the whole of the experiments since 1892 are indicated in the form of a chart—(Chart II.)—and this clearly shows that our inshore waters are becoming richer in plaice, and more especially in dabs.

This chart indicates also the results obtained by the first haul since 1897. In this case all the fishes captured by the trawl are enumerated, while in the whole day's experiment to which the above figures refer, it is only the marketable fishes which are counted. For this period of years, moreover (1897 to 1902), a series of charts (Charts III. to VII.) have been prepared with a view to contrasting the results which are to be obtained by a haul of one hour's duration with those to be got by our complete experiment. These show that while the shorter experiment is sufficient to indicate the general nature of a particular station as regards proportions and kinds of fishes, it is not to be relied upon to indicate whether a station or area is gaining or otherwise in its fish population.

In addition to the particulars obtained by the examination of examples of the fishes caught by the trawl, with reference to their maturity and their food, the weight was determined in each case with relation to size.

Samples of the surface and mid-water life were obtained at the various stations as before, and the quantity and general nature of each of these are indicated.

Tables are furnished again by Messrs. Douglas and Fawcus, detailing their catches of crabs and lobsters, and, with the aid of the former, we are able to publish some interesting experiments with regard to the migrations of the lobster. These show that the lobster, in its adult condition, is very local, and completely in-shore in its habits.

Particulars are furnished of the main facts obtained at certain conferences with the fishermen of the district.

A list of some interesting Isopoda, obtained from the deeper waters off the coast, and also an account of Entomostraca from the fresh water Lough at Holy Island are given by Professor Brady. Professor Lebour has examined and reported upon samples of the bottoms from stations which are indicated on a chart—a chart which shows also the localities in which our trawling experiments are made.

Mr. C. N. Dodd, A.Sc., a student of the Zoological Department, to whom we owe the chart of the district above referred to, made some most useful determinations on the relation of weight to size in crabs, which are embodied in a paper on the growth of the shore crab.

Mr. E. P. Witten, B.Sc., Research Scholar, has commenced to examine in detail the nature of the changes accompanying the casting of the crab, and contributes a preliminary report on his results.

Lists are given of the Decapod and of the Amphipod Crustacea from the Northumberland district. Notes on the occurrence this year of the fox shark, with a photograph, by Mr. W. H. Young, and of the lesser rorqual, and other forms are also presented.

The above shows how useful the laboratory has already become to the district and to the College. The fact that several of our students, past and present, utilise it, and with advantage, not merely to themselves, but to the advance of our knowledge of Marine Science, is sufficient excuse for our asking the Technical Education Committee to still further encourage this most useful work in relation to an important local industry by placing one or two scholarships at the disposal of the Zoological Department for Marine Research.

The Laboratory, it must now be said, is becoming too small to accommodate the number of workers who apply for tables, and if the Departmental Committee of the Board of Trade, which has been considering how best researches in relation to the fisheries of this country can be assisted, do not afford us the means of obtaining the extension which has become necessary, we must, for the first time, appeal to the district to help us.

Natural History in general—not merely as applied to fisheries—suffers greatly from the sad lack of books of reference in Newcastle. The libraries of the College, the Natural History Society, the Literary and Philosophical Society, and the Free Library contain a few books of use, but the vast majority we have either to buy ourselves or have to procure from London. Should anyone wish to devote a sum of money to the advancement of Natural History in this district, there is no better purpose for which it could be given than to provide a library for the Zoological Department.

Alexander Meek.

2°W 1°W 0° 1°E

S.B

S.A

North Sunderland
Beadnell
Beadnell Bay
Newton
Dunstanburgh
Craster
Craster Skerries
Boulmer
Alnmouth
Alnmouth Bay
Amble
Hauxley
Coquet Island
Coquet Bay
Cresswell
Newbiggin
Lynemouth Bay
Blyth
Blyth Bay
Whitley Bay
Collywestons
Tynemouth
South Shields
Souter Point
Farne Islands
Skate Roads

A B C D E F G H J K L M N O

CHART I.—NORTHUMBERLAND DISTRICT—
TRAWLING AND DREDGING STATIONS.

Three-mile Limit
Trawling Stations
Dredging Stations indicated by red letters.

DOGGER BANK.

55°

56°

THE TRAWLING EXCURSIONS.

GENERAL RESULTS.

We are able to publish the results of a number of trawling experiments—results which will be found to be very interesting—by the kindness of the Chairman of the Northumberland Sea Fisheries Committee, and we desire to take this opportunity of expressing our grateful thanks to Abd. Dent for the use of the paddle yacht "Stanley." We wish to acknowledge also most cordially the assistance we receive from those who accompany us, and in particular that of Mr. Saunders, of Blyth, in making up the returns, and the help which the Captain and the other members of the crew give us in carrying out the experimental work.

The experiments have been made each year so far as weather permitted in the bays and along the lines depicted in Chart I. The coast line we cover in our experiments from Seaton Sluice to Holy Island is 38 miles. Of this only 12 miles are available for the purpose of experiment, viz.:—

Blyth Bay	1⅞ miles.
Cambois Bay	1¼ miles.
Druridge Bay	3¼ miles.
Ahmouth Bay	3 miles.
Skate Roads	2¼ miles.

The distances between the experimental stations are:—

Blyth Bay and Cambois Bay ...	2 miles.
Cambois Bay and Druridge Bay ...	5 miles.
Druridge Bay and Ahmouth Bay ...	4 miles.
Ahmouth Bay and Skate Roads ...	15 miles.

The following notes give a brief summary of the general observations made at each excursion:—

Skate Roads, June 26th.—One haul was made here in the morning. The temperature of the air was 54° F. and of the surface water 50°. There was a great deal of weed in the bay owing to the prevalent east winds.

Cambois Bay, June 28th.—As this bay was the only one on the coast which would be likely to permit trawl fishing we gave a day of 8 hours to it. Perhaps the most remarkable feature of the day's fishing was the great number of Anglers (*Lophius piscatorius*) captured in the trawl—about 80 were caught during the day. A living *Solen siliqua* and several *Echinocardium pennatifidum* were also obtained from the trawl.

Cambois Bay, July 2nd.—Another day of 8 hours was given to this bay at an interval of four days, and the results will be discussed later. The fishing was again very clean. There was a very heavy proportion of small and immature flat-fishes and gurnards, and in addition to the fishes the trawl brought in one or two edible crabs, a shore crab, and several *Corystes cassivelaunus*. The Anglers were again very numerous.

Alnmouth Bay, July 9th.—Starting at 11·0 a.m. we trawled until 6·30 p.m., when the trawling was brought to a sudden close by the breaking of the beam at the north-end of the bay more than probably on a piece of wreck. The hauls were very similar to the first detailed in Table III., and in each case the chief feature was the great quantity of small gurnards. There were also many small crabs and plaice, and one small turbot was noted likewise. In addition the trawl brought in several *Echinocardium pennatifidum*, shore crabs, and one *Hyas araneus*.

Druridge Bay, July 16th.—Beginning at 10·20 we gave 8½ hours to this bay. For the first time this season the number of large marketable fishes was conspicuously greater. There was a large number of soles, and of the total 11 were captured at the last haul. In the days when the in-shore fishermen were in the habit of using small trawls, that is when the in-shore waters were open, the best catches of soles were made at night. A slight quantity of weed was picked up, but not sufficient to be a trouble. The weed as usual was swarming with Amphipods—*Gammarus locusta* and *Paratylus swammerdami* principally. Several *Echinocardium pennatifidum* and *Portunus holsatus* were obtained. There were about 8 or 9 Anglers at each haul.

Cambois Bay, July 23rd.—Another day of 8 hours was given to this bay, and the results will be referred to later. A gurnard was caught on this occasion, which we have not seen before at any of the excursions during the last 6 years. This was the Sapphirine Gurnard—*Trigla hirundo*. It is easily distinguished from the common gurnard by the large pectoral fins, which are dark blue

above, edged with light blue, and crossed by dark bands—the rays on the under side of this fin being yellow. This gurnard measured 7¼". A *Cottus quadricornis* was also procured.

A peculiarly coloured variety of the plaice was seen. The eyes were on the right side as usual, and the pigment of the upper side was normal, except that a large area extending from the anterior end of the straight portion of the lateral line to and including part of the ventral (anal) fin was white, like the under side. Two small isolated spots of pigment occurred in this area. The fish, which measured 11½", was a female, otherwise healthy, and the stomach was filled with several small sand-eels and *Tellina tenuis*.

Skate Roads, July 30th.—An hour's haul was made between 5·30 and 6·30 a.m. There was again a great deal of weed, especially at the southern part of the bay.

Alnmouth Bay, July 30th.—We began at 8·10, but the first haul produced nothing, the net having got fouled when it was put overboard. The second haul, from 9·55 to 10·5 a.m., was the one measured (Table III.) A large grey skate was caught, which had lost a triangular piece of the anterior portion of the pectoral fin, and including the side of the mouth. It was alive and was returned to the water. There was no weed in this bay, and in addition to the fishes, a *Mya arenaria*, several *Echinocardium pennatifidum*, and shore crabs were picked up by the trawl.

Druridge Bay, August 20th.—Trawling was begun at 10·15 a.m. and continued for 8½ hours. The sky was overcast during the day, and several thundery showers, sometimes very heavy, fell. The air was 59° and the water 54° F. A *Balænoptera rostrata*, about 30 feet long, had been stranded here on the previous day, and we had therefore the opportunity of seeing it. (See page 71).

Alnmouth Bay, August 27th.—Beginning at 11·10 a.m. we fished here for 8 hours. The morning was misty when we left Blyth, but the mist rapidly cleared away. The air was 57° and the water 54° F. The table shows that the trawling to-day was remarkable from the large catch of soles. The Anglers, especially small ones, measuring 9 to 12 in., were again very numerous. One of the large Anglers was found to have eaten one of his own species only half his size. It is worth stating too, that a sole was caught to-day on the hook. An interesting variation in the colour of the sole was seen in one specimen—it was pigmented on the blind side over three-fourths of the surface from the caudal end. The flounders measured (see Table VI.) included one with the eyes on

the right side. *Portunus holsatus* was as usual very common, and two *Cyprina islandica* were also procured.

Skate Roads, September 3rd.—A single haul of 40 minutes duration was made here in the morning, just before the occurrence of a heavy gale from the south east.

Blyth Bay, September 11th.—After a day or two of easterly wind, which still continued, there was a heavy easterly swell, and it was only possible to fish the bay from south to north. Allowing for the loss of time involved in steaming back to the south-end of the bay we fished 5½ hours, commencing at 9·40 a.m. The air was 53° and the water 53° F. The fishing was, as will be seen, very good, but it was noteworthy that amongst the six gurnards caught, only one was the common gurnard, the other five being the Sapphirine Gurnard mentioned in the notes for July 23rd above.

THE MARKETABLE FISHES CAPTURED.

This season has been an extraordinary one as far as the weather is concerned. It has been cold and rainy, with prevailing easterly winds. The above notes and the last column in Table I. show to some extent the general character of the weather during the summer. But the season has been no less extraordinary with regard to the fishing industry. The herring fishing and also the summer fishing for salmon and trout were most successful. Large numbers of mackerel were caught not only by lines, but in the salmon and trout nets, and the in-shore waters were teeming with sprats and young herrings.

A trawl owner assured us that this year there have been very large catches of cod—as many as 40 score being obtained at one haul of the net. The landings of black soles have also been exceptionally good—in one instance 250 pairs were caught in one night. A feature of the season has been the enormous quantities of small haddocks in all parts of the North Sea visited by our trawlers. Thousands of tons have had to be thrown overboard.

Our trawling experiments show that the ground fishes were present in the in-shore waters also in unusually large numbers.

The average catch was as follows:—Turbot 1, sole 21, plaice 165, dab 121, flounder 5, flat fishes 317. In the report for 1898, a chart was published showing the results in a graphic form up to that date. In the chart now given (chart 2) the results are shown

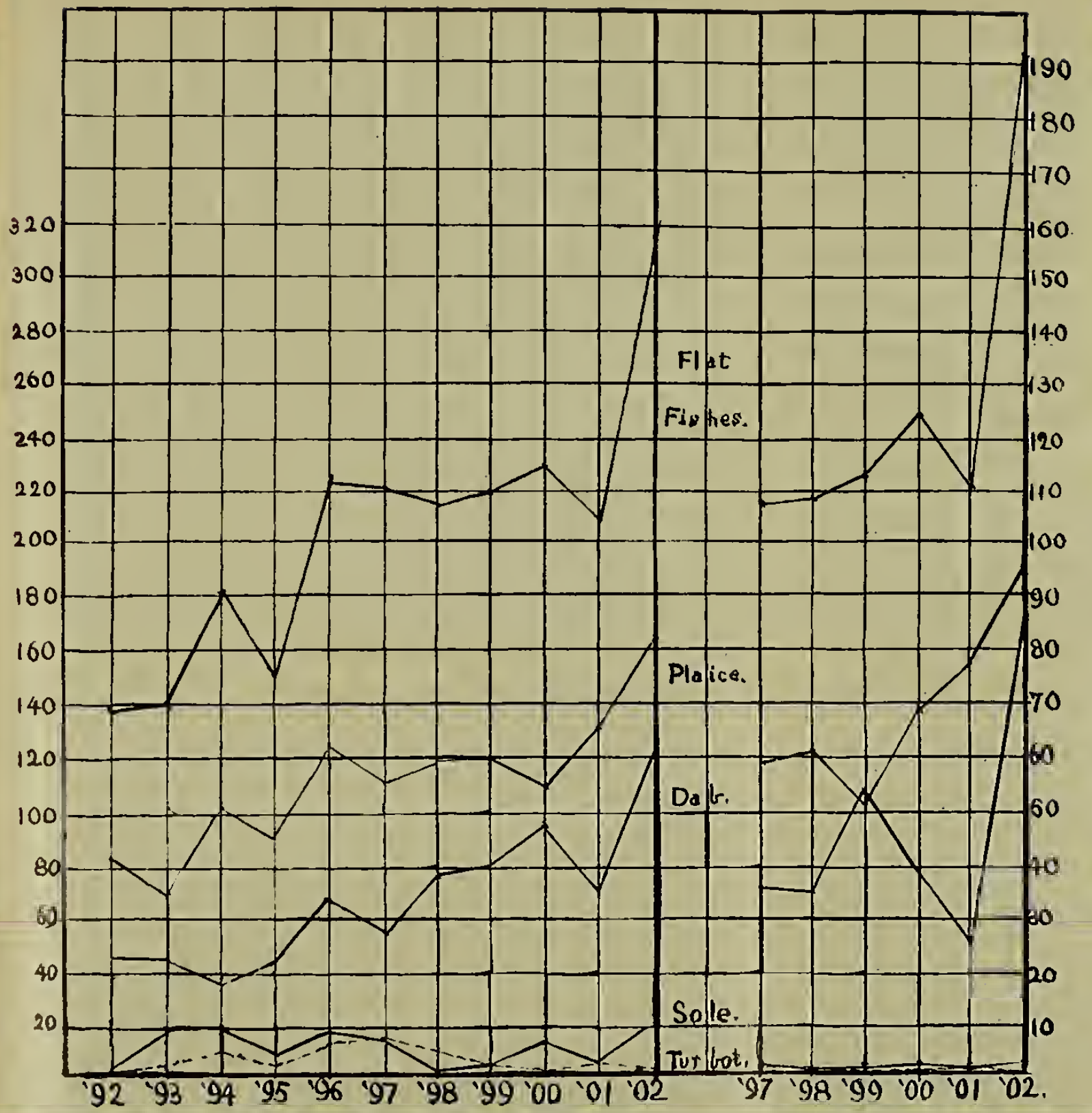

CHART II.—The curves to the left show the average catches of flat fishes, plaice, dab, sole, turbot (the latter distinguished by a dotted line), from 1892 to 1902. The curves to the right show in similar manner the average catches of the same classes of fishes at the first haul from 1897 to 1902.

AMERICAN MUSEUM OF
NATURAL HISTORY

TABLE I.

PLACE.	DATE.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Lemon Dab.	Flounder.	Whiting.	Haddock.	Codling.	Gurnard.	Skate.	Total.	Mean Temp. of Surface	SEA.	WIND.
	1902.																
Cambois Bay, 8 hours ...	June 28th...	1	1	21	121	95	1	4	1	...	...	7	...	255	50	Smooth	S.E., clear
Cambois Bay, 8 hours ...	July 2nd ...	1	...	10	92	152	...	6	...	...	...	1	1	263	51	Rough	N.E., clear
Ahmouth Bay, 7½ hours...	,, 9th ...	1	...	11	126	124	...	2	...	3	...	49	...	316	52	Smooth	N.W., cloudy, showers
Druridge Bay, 8¼ hours ...	,, 16th ...	7	...	30	196	111	...	1	...	...	...	31	...	379	53	Do.	E., light, cloudy
Cambois Bay, 8 hours ...	,, 23rd ...	...	...	20	130	100	...	8	3	1	...	13	...	278	53	Moderate	S.E., cloudy, showers
Ahmouth Bay, 8 hours ...	,, 30th ...	3	...	18	88	100	...	13	...	1	...	51 *x*	...	271	53	Smooth	W., changing to S.E., over cast, shower
Druridge Bay, 8¼ hours ...	Aug. 20th ...	10	1	13	321	215	...	7	...	...	...	37 *xx*	...	607	51	Do.	W., cloudy
Ahmouth Bay, 8 hours ...	,, 27th ...	11	1	10	120	100	...	5	...	...	...	40 *xx*	...	320	51	Do.	S.E., light misty morning
Blyth Bay, 5½ hours ...	Sept. 11th...	...	...	23	290	89	...	2	...	2	3	6 *xxx*	...	415	53	Moderate	E., cloudy

x. Including many taken by line. *xx*. Including many taken by line, a few Mackerel were also caught by the line.
xxx. 1 Common Gurnard and 5 Sapphirine Gurnards caught by the trawl.

for the whole period of eleven years during which the trawling experiments have been made—based on Table II. (A). It shows that the total flat fishes and the plaice and the dab have improved almost steadily since the closing of the in-shore grounds to trawlers, and the conspicuous change in their general onward trend this year is also strikingly apparent.

TABLE II. (A).—Average catches of turbot, sole, plaice, dab, and the total flat fishes for eleven years.

YEAR.	Turbot.	Sole	Plaice.	Dab.	Total Flat Fishes.
1892	1	5	84	46	138
1893	5	20	70	45	140
1894	12	20	103	35	181
1895	3	8	92	46	152
1896	13	18	124	68	224
1897	15	14	112	56	221
1898	11	2	117	77	215
1899	6	6	120	81	220
1900	4	14	110	96	231
1901	6	7	130	73	211
1902	4	21	165	121	317

(B).—Average catches of turbot, brill, sole, plaice, dab, flounder, and the total flat fishes for six years—first haul.

Year.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total. Flat Fishes.
1897	1·7	...	2·6	59·7	36·1	7·3	107·4
1898	1·4	0·6	0·9	61·2	35·4	8·6	108·1
1899	0·9	...	1·3	51·9	53·1	6·6	113·8
1900	1·1	0·2	2·2	68·6	39·1	13·5	124·7
1901	1·4	0·4	1·1	76·8	26·0	5·0	110·7
1902	0·5	0·2	3·0	94·8	86·3	7·9	192·7

It may probably occur to some that the reason of this increase of fishes in the in-shore waters is due to the strike last year at Grimsby, and the consequent lying idle of a large number of trawl steamers for a portion of the year. But when we recollect, as has already been stated, that the salmon and trout fisheries and the herring fisheries have been unusually productive this summer, that there have also been much larger numbers of mackerel on the coast, that unusual fish have also visited the coast, we conclude that the increase is due to the season. If a reason has to be sought for the increased population of the North Sea this season, and its rather unusual nature, it may be suggested that it is more than likely one of temperature. The North Sea, in a wide sense, is only a large bay in the North Atlantic. A favourable change in the temperature of the larger ocean would tend to tempt the fish from the North Sea, and an unfavourable change would not merely repel them, but would add many which normally would remain in the North Atlantic. Thus the present year must be looked upon as exceptional, and we must bear in mind that in all probability other or opposite conditions would cause a diminution. It shows how important the hydrographical researches are likely to be which are to be conducted simultaneously by the North Sea Powers during the next five years.

The different bays have naturally participated in the general increase. Cambois Bay, which was experimented in at intervals of 4 days and 21 days, showed a slight progressive increase in the total number of fishes on each occasion, with inconsiderable fluctuations in the proportion of the fishes, as well as the general improvement in numbers over former years.

The only haul made at Blyth Bay was a record one, the total reaching 415 fishes. This catch we obtained in 5¼ hours in a moderately rough sea. The improvement affected soles, plaice, and dabs, and the catch was remarkable, moreover, in that 5 Sapphirine Gurnards were captured there for the first time, and only one common gurnard.

At Druridge Bay, where we made two experiments, the results were even more striking. The average catch, as is shown graphically in chart V., was greatly in advance of anything we have had to record during the whole of the years this bay has been visited. The great improvement of the second day's catch over that of the first offers a striking confirmation of the fact our

experiments have evidenced in the past that during the summer the bays gain greatly in their fish population. This bay benefits from the in-shore migration to a most conspicuous degree.

Almouth Bay shows this year, curiously enough, a decrease compared with the four previous years, affecting plaice and dabs, but there was an increase of soles.

The weather prevented us this year, as in 1900, from making a full experiment at Skate Roads, but the results, so far as they refer to three single hauls, are given in the next section.

DETAILED ANALYSIS OF THE FIRST HAUL.

The first haul, in some cases the only haul, which we endeavour to make on every occasion one of an hour's duration, was carefully dealt with as before, every fish, useful or otherwise, being measured.

This has now been done for a sufficient number of years to enable us to compare the results of this method of experiment, with the one which had been adopted and carried out by the Chairman for some years before we joined in the work, and which for the sake of comparison we were desirous to continue. It has an historic interest moreover, because the method of Mid Deut was practically the same method which was adopted by Prof. McIntosh in the first experiments of the kind ever tried. The fishes caught at each haul were divided into two lots, the marketable and the unmarketable. The latter were at once returned to the sea, and, as we have pointed out before, with the result of a total survival at all events so far as the flat fishes are concerned.

The Scottish Fishery Board's experiments when they were instituted were made on the lines of that adopted for registering our first haul, only two hours were usually given to each station instead of one, as in our case. But it is at once plain, apart from the fact that the measurements indicate the numbers obtained of the various sizes, that the returns merely take cognisance of all the fishes captured in a net of a given mesh, in our case, and, so far as is apparent, in that also of the Scottish Fishery Board of all fishes measuring 4" long or more. In other words, the judgment of the eye is replaced by the automatic choice of the net.

Is the shorter experiment made by the latter method to be preferred to the longer experiment made on the former plan?

Table II. (B) shows the average catches made by the net of the flat fishes at the first haul from 1897 to 1902, and from these results the right hand part of Chart II. has been prepared. It is plain from the tables and the chart that the two methods do not tell exactly the same story. A sudden rise in the case of the dabs in 1899 and a decrease during 1900 and 1901 is what is shown by the first haul. A steady increase, with a decrease only in 1901, is what the total experiment indicates during the same period. The first haul shows a decrease in 1899 and an increase in 1900, with regard to plaice. For this species, the total experiment gives practically an opposite result. The general improvement in plaice and the total flat fishes is on the whole, however, borne out by the results of the first haul.

TABLE III.

SKATE ROADS, June 26th, 1902 (1 hour.)

INCHES.

	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total.
Plaice ...	...	1	24	9	5	4	...	3	...	2	2	...	...	..	...	...	...	50
Dab ...	...	...	1	3	...	...	1	...	...	...	...	...	...	...	...	...	...	5
Flounder...	...	...	...	1	3	1	...	..	1	...	...	...	...	1	...	...	...	7
																		62

CAMBOIS BAY, June 28th (1 hour.)

Plaice ...	..	...	11	14	20	9	4	6	6	1	2	..	...	...	...	..	...	73
Dab ...	..	...	6	26	15	4	2	2	2	...	..	..	...	...	...	...	.	57
Sole ...	..	...	..	...	...	3	...	1	..	...	...	...	...	...	...	...	...	4
Flounder...	.	...	1	4	6	6	2	..	...	...	..	...	...	...	..	...	...	19
Gurnard ...	...	5	12	8	9	1	1	..	...	...	1	..	...	...	...	...	...	37
Angler ...	...	...	...	...	...	...	...	...	1	2	3	2	1	...	...	3	...	12
																		202

CAMBOIS BAY, July 2nd (1 hour)

Plaice ...	...	3	21	25	28	17	2	3	3	1	...	1	...	...	...	...	...	104
Dab ...	..	...	28	58	26	9	5	3	1	1	...	...	...	...	...	...	...	131
Sole ...	...	..	.	...	1	1	1	1	...	...	...	...	...	...	...	..	...	4
Flounder...	..	...	3	6	9	1	...	1	...	..	..	...	...	..	..	...	...	20
Gurnard ...	2	2	4	4	1	1	...	...	...	...	...	..	..		..	...	...	14
Angler ...	...	...	..	...	1	1	...	1	1	1	2	3	4	1	...	..	...	15
																		288

ALNMOUTH BAY, July 9th (1 hour)

Plaice	2	2	11	15	14	5	3	3	...	..	...	...	...	...	...	..	...	55
Dab	2	24	68	13	7	2	3	...	1	..	..	...	...	...	...	..		120
Sole	...	..	...	..	..	1	...	1	...	...	...	...	...	...	...	...	.	2
Gurnard	4	74	125	46	16	5	6	3	1	1	..	...	...	...	...	...	...	281
Angler	...	..		...	...	1	...	...	2	...	...	...	2	...	...	2		7
																		465

DRURIDGE BAY, July 16th (1 hour.)

Plaice	...	1	1	1	11	4	5	12	8	4	...	...	..	..	...	..	47
Dab	..	2	24	14	9	3	1	..	..	..	...	...	...	...	...	..	53
Sole	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Turbot	...	..	...	..	...	...	...	...	...	..	...	...	1	...	...	...	1
Gurnard	...	8	22	11	4	1	1	...	...	...	...	..	...	...	...	..	47
Angler	..	...	...	1	...	1	1	...	3	2	...	...	...	...	...	...	8
																	157

CAMBOIS BAY, July 23rd (1 hour.)

Plaice ...	...	3	10	35	24	19	7	4	4	1	1	...	...	...	...	...	...	108
Dab ...	1	...	28	36	15	7	3	4	2	3	...	..	...	...	...	...	..	99
Sole ...	...	...	...	...	...	5	1	1	...	1	...	...	...	...	..	...	..	8
Flounder .	...	..	1	2	2	4	.	...	..	...	...	...	...	...	...	...	...	9
Whiting ...	..	...	..	...	1	1	...	...	.	...	...	...	...	...	...	..	...	2
Gurnard ...	...	...	3	5	1	1	...	...	1	...	...		...	...	...	...	.	11
Angler ...	..	...	...	..	1	..	..	...	1	...	...	1	...	..	...	...		3
																		240

TABLE III.—CONTINUED.

SKATE ROADS, July 30th (1 hour.)

	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total.
Plaice ...	...	7	21	70	42	17	11	9	5	2	1	..	...	...	...	..	..	185
Dab ...	...	...	1	7	4	4	...	1	...	...	1	..	...	...	...	..	.	18
Turbot ...	..	...	...	...	...	...	1	...	...	..	...	..	...	...	...	...	.	1
Brill ...	..	1	..	..	...	...	..	...	1	..	...	...	..	..	..	...	..	2
Flounder ..	...	..	...	1	...	2	...	1	1	...	1	...	...	...	...	...	.	6
Gurnard ...	1	...	..	...	...	...	...	...	...	..	..	...	...	...	..	...	..	1
																		213

ALNMOUTH BAY, July 30th (1 hour 10 minutes.)

Plaice ...	...	8	14	7	23	6	5	8	5	8	2	1	...	..	...	...	...	87
Dab ...	1	2	22	46	19	13	7	...	..	...	...	...	...	...	...	...	...	110
Sole ...	..	...	...	..	..	3	..	..	...	..	...	...	..	...	...	..	...	3
Flounder...	...	...	1	6	6	3	4	...	...	...	...	1	...	...	...	...	...	21
Gurnard ...	1	11	47	52	8	1	...	...	..	1	...	1	...	...	...	...	...	125
																		346

DRURIDGE BAY, August 20th (1 hour.)

Plaice ...	...	...	6	3	5	15	20	10	34	30	14	2	2	1	...	1	..	143
Dab ...	..	3	13	46	52	26	12	4	1	...	...	..	..	...	...	...	..	157
Sole ...	...	..	...	...	..	...	1	1	1	..	...	...	...	..	..	...	.	3
Flounder...	...	...	...	..	...	1	.	...	..	...	...	..	..	...	...	...	...	1
Codling ...	...	...	...	...	...	...	1	...	...	...	...	..	...	...	...	...	...	1
Gurnard ...	...	...	1	9	29	10	7	3	2	1	..	..	..	...	..	...	.	62
Angler ...	..	...	..	..	1	...	2	...	...	..	...	...	1	1	..	...	...	5
																		372

ALNMOUTH BAY, August 27th (1 hour.)

Plaice ...	...	2	9	1	19	18	6	4	6	5	2	2	...	1	1	..	.	76
Dab ...	...	2	10	72	34	9	6	1	1	..	..	...	...	..	...	...	.	135
Sole ...	..	...	...	...	...	...	1	..	2	..	...	...	...	...	...	...	..	3
Turbot ...	...	...	...	...	...	.	..	2	...	...	1	...	..	...	...	...	...	3
Flounder...	...	...	...	..	1	1	...	1	...	...	1	..	...	..	...	..	...	4
Gurnard ...	...	5	2	7	7	5	2	4	3	1	...	..	..	...	...	..	...	36
Angler ...	...	...	..	..	...	2	1	3	2	..	...	..	...	1	...	1	...	10
																		267

SKATE ROADS, September 3rd (40 minutes.)

Plaice ...	...	1	9	7	6	4	2	6	3	2	3	...	...	..	..	...	...	43
Dab ...	...	1	1	2	1	3	2	...	...	...	...	...	...	...	...	...	...	10
Sole ...	..	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	2
Turbot ...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	2
Flounder...	...	...	...	...	1	...	1	...	...	...	...	1	...	...	...	...	...	3
Gurnard ...	...	...	1	...	1	8	4	1	2	...	...	...	...	...	...	...	...	17
Angler ...	...	...	...	...	...	...	...	1	2	...	...	...	...	...	...	...	...	3
																		80

BLYTH BAY, September 11th (50 minutes.)

Plaice ...	...	1	16	6	8	29	29	11	4	10	1	...	...	...	...	...	...	115
Dab ...	...	...	2	14	26	16	6	1	...	...	...	...	...	...	...	...	...	65
Sole ...	...	...	...	...	...	1	1	1	...	...	1	...	1	...	...	...	...	5
Cod ...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	2
Sapph. Gurnard ...	...	...	...	1	1	..	...	...	...	...	...	...	...	...	...	...	...	2
Angler ...	...	...	...	...	...	1	1	1	1	1	...	1	1	...	...	...	...	7
																		196

In Table IV. the total and average catches made at the first haul are brought together with reference to each bay, and in Table V. the average catches for the corresponding years for the whole day's experiment are presented. The average results for each year as shown by these tables have been used to prepare Charts III. to VII. In these charts the narrow columns represent the average catches of flat fishes for each year as determined by the first haul, and the wide columns the average catches of flat fishes obtained by the whole day's experiment. In each case, the column is divided into sections showing the proportion of each kind of flat fishes. Beginning at the bottom of the column the species are indicated as follows:—Turbot (upright lines), brill (plain), soles (black), plaice (plain), dabs (oblique lines), flounder (plain) With regard to these Charts, it ought to be pointed out that while the two classes of experiment are complete in the case of Ahmouth and of Druridge Bay, they are more or less incomplete for the other places. At Skate Roads, there was no complete day's experiment made in 1900 nor in 1902, and there was no record obtained of the first haul for 1897. The record for Cambois Bay is complete, with the exception of 1900, when no whole day's experiment was made. For Blyth Bay, the results are so incomplete with reference to the whole day's experiment that columns have been prepared only to represent the first haul.

Thus bringing together the results of the two classes of experiment, we find in the first place that the first haul does fairly accurately depict the relative proportion of the fishes at a given place.

For example, at Skate Roads, the catch consists for the most part of plaice, with smaller numbers of dabs, turbot, brill, soles, flounders. The larger proportion of dabs at Druridge, at Ahmouth and at Cambois Bays, is also about equally well shown by the first haul as by the larger experiment. This shows, therefore, that the proportion of the different classes is much the same for the fishes of small as for those of large size.

The bays are indeed remarkably characteristic whether considered from the point of view of the marketable fishes or from that of the complete catches. The Southern stations agree very closely in the proportion of the fishes, but Skate Roads is very different from all the others. It is interesting to note that Goswick Bay to the north of Holy Island agrees with Skate Roads in this respect (see reports for 1898 and 1899.) We can almost trace, however,

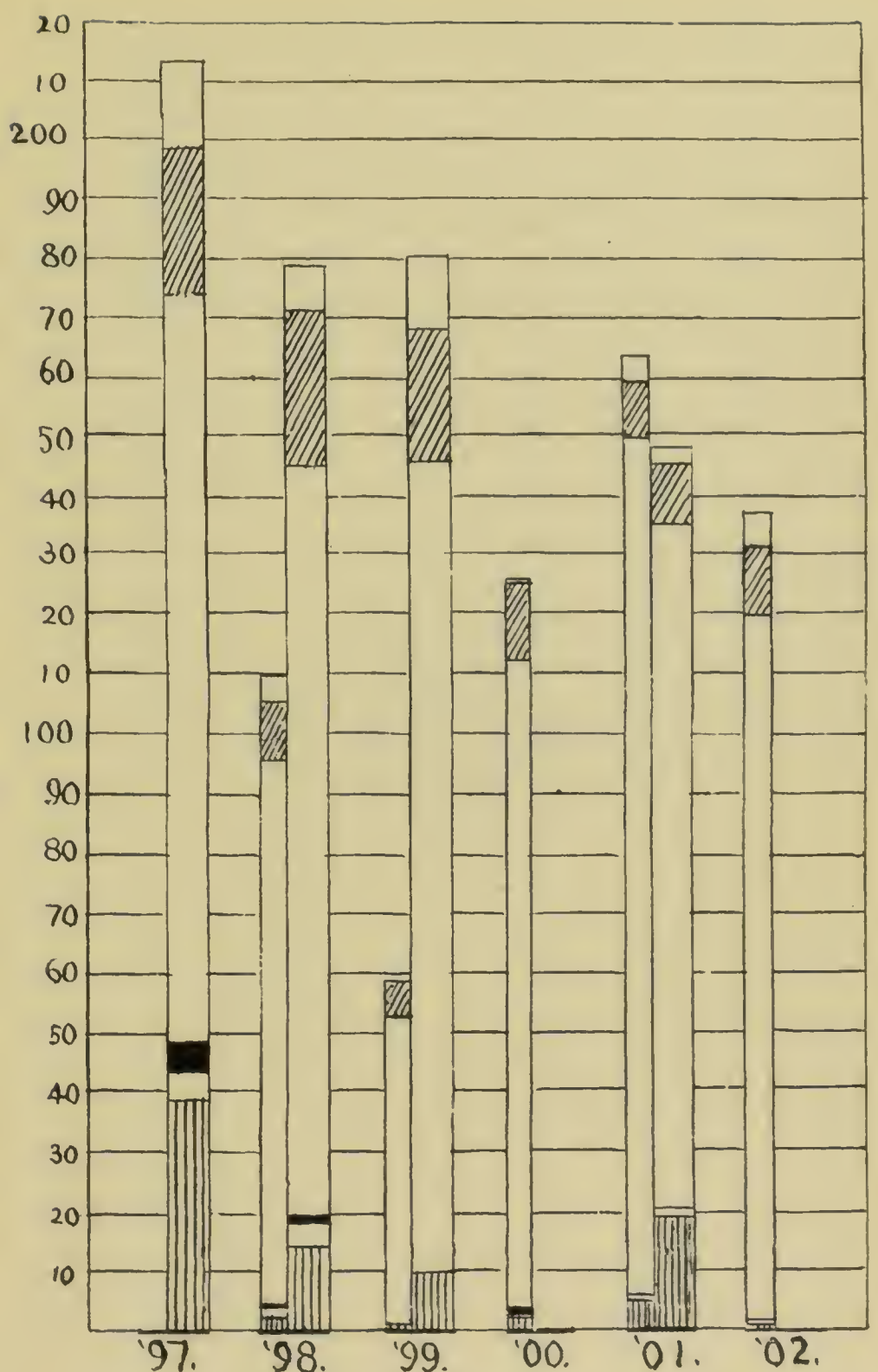

Chart III.—Skate Roads.—The narrow column in each case represents the first haul; the wider column, the whole day's experiment.

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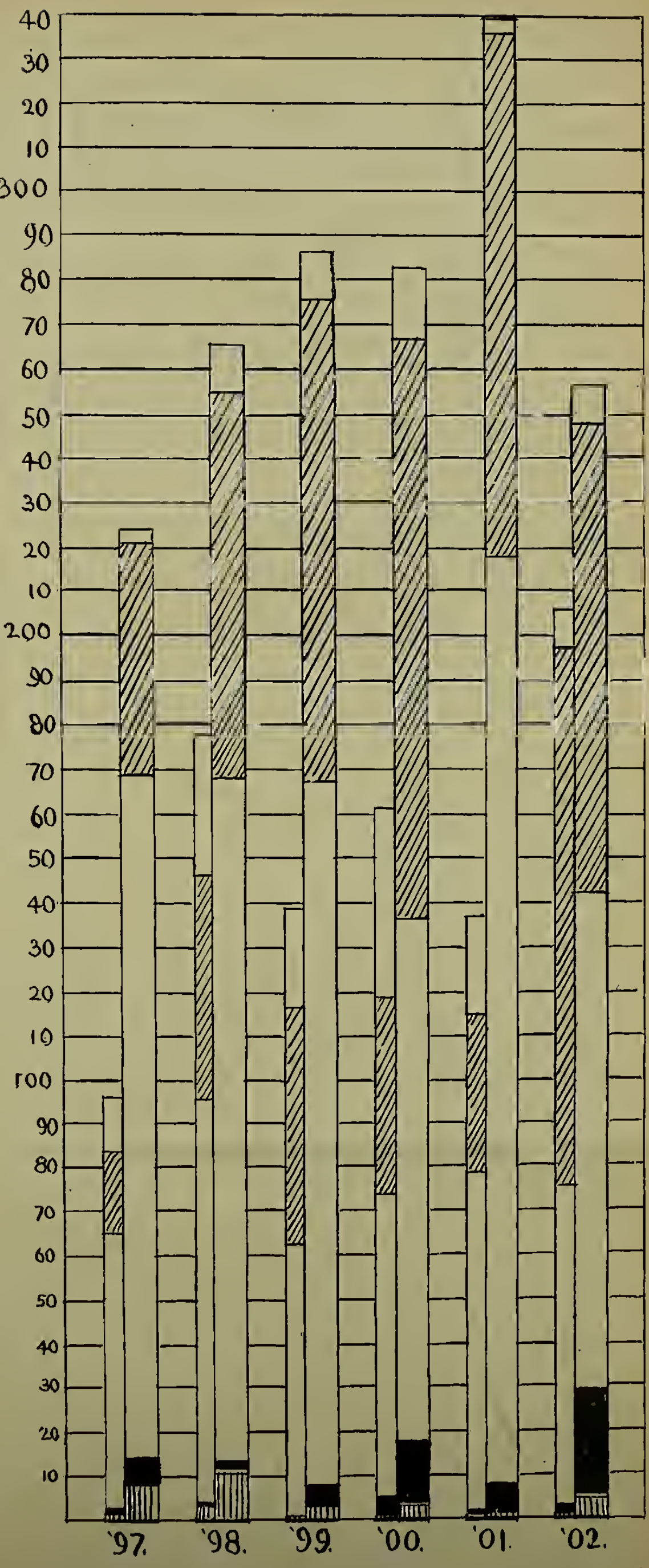

Chart IV.—Alnmouth Bay.—The narrow column in each case represents the first haul; the wider column, the whole day's experiment.

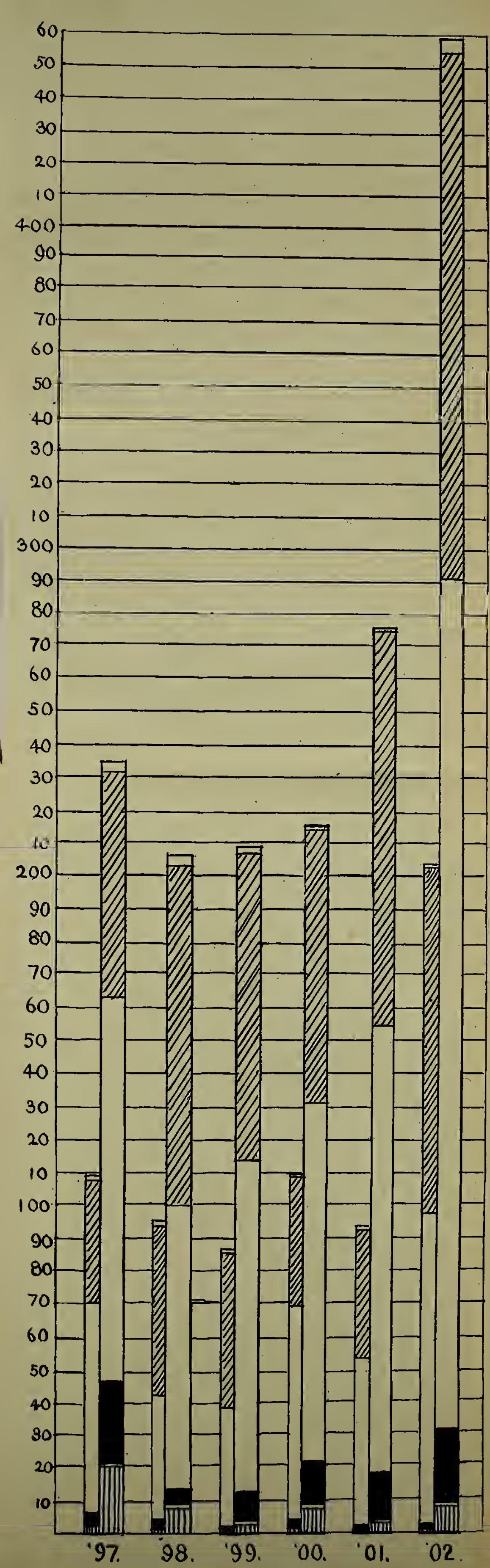

Chart V.—Dredbridge Bay.—The narrow column in each case represents the first haul; the wider column, the whole day's experiment.

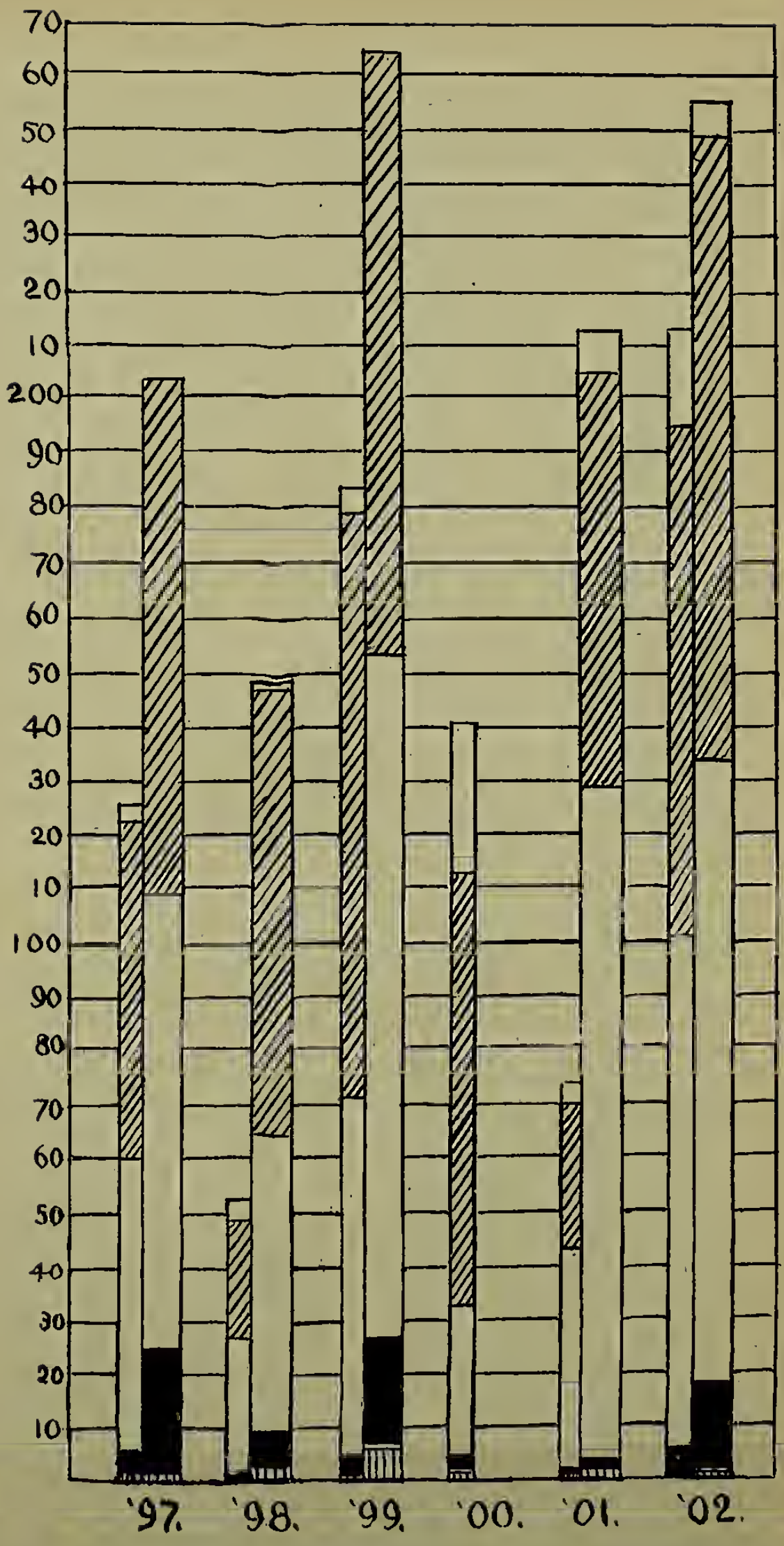

Chart VI.—Cambois Bay.—The narrow column in each case represents the first haul; the wider column, the whole day's experiment.

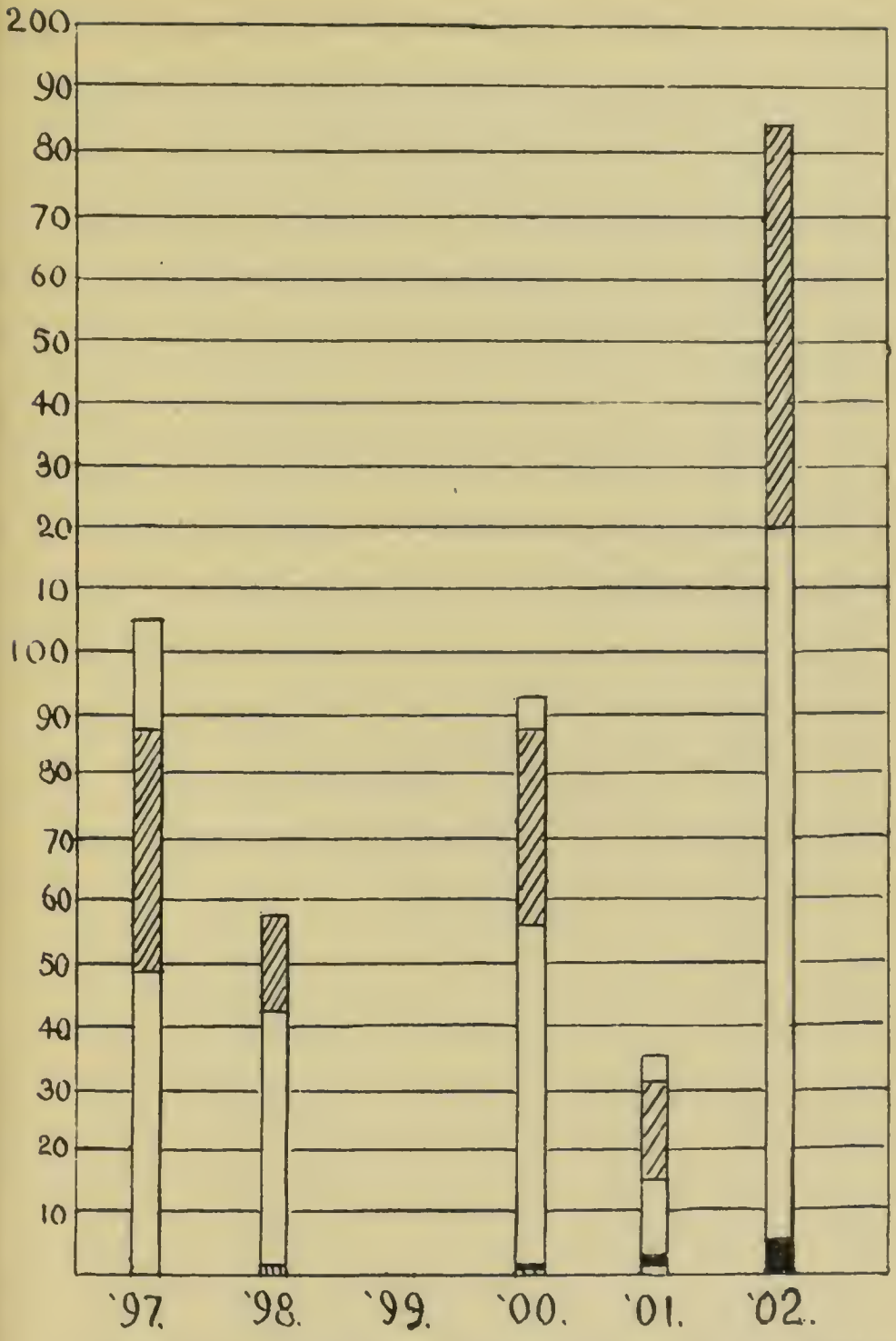

Chart VII.—Blyth Bay.—The columns represent only the first haul.

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TABLE IV.—The average catches made at the first haul for the years 1897-1902—flat fishes.

SKATE ROADS.

YEAR.	DATE.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total Flat Fishes.
1898	June 23	2	3	...	36	5	6	52
	Aug. 1	1	1	1	148	14	1	166
	Average	**1·5**	**2**	**0·5**	**92**	**9 5**	**3 5**	**109**
1899	June 21	...	...	...	20	2	2	24
	Aug. 7	2	...	..	82	11	2	97
	Average	**1**	..	...	**51**	**6·5**	**2**	**60·5**
1900	Aug. 6	...	...	2	138	10	1	151
	Sept. 17	3	1	...	79	18	...	101
	Average	**1·5**	**0 5**	**1**	**108·5**	**14**	**0·5**	**126**
1901	June 10	3	...	...	112	11	...	126
	,, 26	6	1	...	174	14	9	204
	.. 28	3	1	...	203	8	2	217
	Aug. 6	6	1	...	89	4	1	101
	Average	**4·5**	**0 75**	...	**144·5**	**9·25**	**3**	**162**
1902	June 26	...	...	...	50	5	7	62
	July 30	1	2	...	185	18	6	212
	Average	**0·5**	**1**	...	**117·5**	**11·5**	**6·5**	**137**

ALNMOUTH BAY.

1897	July 7	1	...	...	34	22	3	60
	Aug. 19	2	...	1	91	14	24	132
	Average	**1·5**	...	**0 5**	**62 5**	**18**	**13·5**	**96**
1898	July 6	2	...	1	77	43	40	163
	.. 27	3	...	...	105	62	24	194
	Average	**2 5**	...	**0·5**	**91**	**52·5**	**32**	**178·5**
1899	July 5	...	...	...	29	69	18	116
	Sept. 6	1	...	...	93	40	28	162
	Average	**0·5**	...	...	**61**	**54 5**	**23**	**139**
1900	June 29	...	...	1	84	38	34	157
	July 25	1	...	3	49	42	51	146
	Aug. 14	1	...	5	77	57	40	180
	Average	**0·7**	...	**3**	**70**	**45 7**	**41·6**	**161**
1901	July 24	...	...	1	23	30	3	57
	Aug. 14	...	1	1	132	42	42	218
	Average	...	**0·5**	**1**	**77·5**	**36**	**22·5**	**137·5**
1902	July 9	...	...	2	55	120	...	177
	.. 30	...	...	3	87	110	21	221
	Aug. 27	3	...	3	76	135	4	221
	Average	**1**	...	**2·7**	**72·7**	**121·7**	**8·3**	**206·4**

DRURIDGE BAY.

YEAR.	DATE.	Turbot.	Bril.	Sole.	Plaice.	Dab.	Flounder.	Total Flat Fishes.
1897	June 30	2	...	1	65	31	...	99
	July 28	3	...	9	73	26	...	111
	Sept. 1	3	...	2	52	58	3	118
	Average	**3**	...	**4**	**63**	**38**	**1**	**109**
1898	June 30	1	...	1	39	38	...	79
	July 20	2	1	1	27	89	3	123
	Aug. 31	1	...	3	52	30	1	87
	Average	**1·3**	**0·3**	**2**	**39**	**52**	**1·4**	**96**
1899	July 19	...	...	...	6	21	1	28
	,, 26	2	...	1	28	70	...	101
	Aug. 23	1	...	3	77	49	2	132
	Average	**1**	...	**1**	**37**	**47**	**1**	**87**
1900	June 20	3	...	1	72	17	1	94
	Aug. 1	1	...	2	79	52	...	134
	,, 6	1	...	2	57	19	1	80
	Sept. 12	...	...	8	50	72	...	130
	Average	**1·25**	...	**3·25**	**64·5**	**40**	**0·5**	**109·5**
1901	July 10	...	...	4	31	16	1	52
	,, 31	...	...	2	31	87	...	120
	Sept. 4	...	...	1	26	15	1	43
	,, 12	...	...	3	116	39	1	159
	Average	...	...	**2·5**	**51**	**39·25**	**0·75**	**93·5**
1902	July 16	1	...	1	47	53	...	102
	Aug. 20	...	...	3	143	157	1	304
	Average	**0·5**	...	**2**	**95**	**105**	**0·5**	**203**

CAMBOIS BAY.

1897	July 14	1	...	5	54	63	3	126
1898	Aug. 10	...	...	1	26	22	2	51
1899	Aug. 16	1	...	6	48	169	3	227
	,, 30	1	...	2	84	47	3	137
	Average	**1**	...	**4**	**66**	**108**	**3**	**182**
1900	July 11	2	1	2	27	80	28	140
1901	July 3	1	...	1	43	35	6	86
	Aug. 28	...	...	1	71	38	1	111
	Sept. 4	...	...	...	12	8	...	20
	Average	**0·3**	...	**0·7**	**42**	**27**	2	**72**
1902	June 28	...	...	4	73	57	19	153
	July 2	...	...	4	104	131	20	259
	,, 23	...	...	8	108	99	9	224
	Average	...	...	**5·3**	**95**	**95·7**	**16**	**212**

BLYTH BAY.

YEAR.	DATE.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total Flat Fishes.
1897	Aug. 25	...	...	...	49	39	18	106
1898	July 13	1	...	...	41	16	...	58
1899								
1900	July 4	...	...	...	59	23	1	83
	Sept. 5	1	...	1	52	41	5	100
	Average	**0·5**	...	**0·5**	**55·5**	**32**	**3**	**91·5**
1901	July 3	...	1	2	12	17	4	36
1902	Sept. 11	...	...	5	115	65	...	185

even with reference to the few years thus shown, that the increase in dabs at the Southern stations is a modern feature, that, in fact, the proportion of dabs is becoming greater.

If our object were only to determine the condition of the bays as regards the relative numbers of the fishes present in each case, such an experiment would be all that would be necessary for the purpose.

There are some cases, however, in which the first haul, while showing the general conditions so far as the dominant fishes are concerned, do not at all indicate the presence of fishes which occur in small numbers.

But, if the experiments are to be made to form the basis of a comparison to indicate whether the waters are gaining or otherwise in fish-population, it is evident they must be made on a larger scale than that which we have been describing as "the first haul," for this does not always agree in its results with our complete experiment.

In the Chart for Skate Roads, for example, the first hauls for 1898 and 1899 show a decrease for the latter year. The complete results are as nearly as possible equal. Again, in 1901, a considerable increase is shown by the first haul; a decrease by the complete experiment.

Similar discrepancies can be seen by looking over the Charts for Ahmouth Bay, Druridge Bay, and Cambois Bay.

The general average results agree in pointing to the richness of the in-shore waters during the past summer, but even here the story as told by the two methods is not in absolute agreement.

TABLE V.—Average results of the complete trawling experiments for the years 1897-1902—flat fishes.

SKATE ROADS.

YEAR.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total.
1897	38·5	4·5	5·5	124·5	25	15·5	213·5
1898	15	3	1·5	124·5	27·5	6·5	178
1899	9·5	...	...	136·5	22	12	180
1901	19·5	1	...	113·5	10·5	3	147·5

ALNMOUTH BAY.

1897	7	...	6	155·5	52·5	3	224
1898	10	1	1·5	156	86	11·5	266
1899	3·5	0·5	4·5	158·5	107·5	10·5	285
1900	2·3	0·3	16	118	130·7	14·4	281·7
1901	1	...	7·5	209·5	118·5	3	339·5
1902	6	0·3	23	111·3	108	6·7	255·3

DRURIDGE BAY.

1897	20·5	0·5	26	115·5	69	3	234·5
1898	8·7	1	4	86	104·3	2	206
1899	4·3	0·7	8	100·3	94	1·3	208·6
1900	8·5	1	11·5	110·5	83	0·5	215
1901	2·7	0·3	15	136·7	119·6	0·7	275
1902	8·5	0·5	21·5	260	164·5	4	459

CAMBOIS BAY.

1897	2·5	...	23·5	83	93	...	202
1898	2	...	7	56	82	1	148
1899	7	1	19	125	112	...	265
1901	2	...	2	126	77	6	212
1902	0·7	0·3	·18	114·3	115·7	6	255

The reasons which may be adduced for explaining the discrepancies are—(1) The differences in size recorded in the two methods. The Tables show, however, that the two classes of experiment are in fair agreement with regard to the proportional numbers of fishes apart from size. (2) The variability of conditions under which successive experiments may be made especially with regard to the state of the tide. Our complete experiments extend over about one phase of the tide in each case, and are thus more likely to afford a more strictly comparable result. Our observations now made for seven years on the Northumberland Coast go to show, moreover, that, although the results at each haul are tolerably uniform, sometimes a gradual and occasionally a sudden change in the numbers caught may be seen in a single day's experiment in one place. This was illustrated in the report for 1897, by the records of successive countings of the smaller fishes.

All this goes to show that the single haul or experiment, of too short duration to cover the diurnal changes to which the fishes are liable, is not sufficient to indicate the nature of the bays in a comparative sense from year to year. All that it can do well is to show the general proportion at a given time of the fishes and their sizes, and, therefore, their stages in life, and a comparison at different seasons in widely spread stations would show the general seasonal migrations.

We have thus reason to thank Ald. Dent for making the experiments which he began in 1892 on the larger scale. It is from the results of these complete experiments that we have been led to conclude that the in-shore waters are richer to-day in plaice and more especially in dabs than they were in 1892, or, in other words, that the favourable areas on our coast shown in Chart I. are attracting a gradually increasing number of these flat-fishes during the two or three months of the summer when the experiments are made. As we have pointed out before, the experiments are as free as possible from error due to variation, because (1) they have been conducted for over ten years, (2) the season during which they are made is short—from about the end of June to the beginning of September, (3) the experiment is made long enough to cover at least one phase of the tide. By the latter statement we mean that during the time the experiment is being conducted, the tide more or less flows *and* ebbs. (4) Very little line fishing takes place in these bays, and practically none at all during the season of our experiments, and trawling is prohibited.

With regard to the wider question as to whether our experiments throw any light upon the conditions of the near North Sea, it ought to be said that our results this year agree with the general experiences of fishermen, and also with the conditions as shown by the Board of Trade returns for the year, and for the three months during which the experiments were made. The exceptional nature of the season has thus affected the in-shore waters as well as the larger area outside our district.

Our results show, however, that even though the season has been a generally good one, the increase has been very conspicuous in Druridge Bay and Blyth Bay, slight in Cambois Bay, and there was actually a slight decrease evident for Almmouth Bay.

THE FOOD, SEX, AND DEGREE OF MATURITY OF THE FISHES.

This year, an additional column is provided in the following table (Table VI.) giving the weights of the fishes. The fishes, examined as in former years, with regard to their food, sex, and degree of maturity, were at the same time carefully measured and weighed. These latter records will be used for stating the progress made in growth.

In the meantime it is only necessary to draw attention to the mature female plaice of $14\frac{3}{4}$ ins. caught on August 20th, and to the fact that this year plaice were often feeding on young sand-eels. Dabs, as before, presented great difficulties in determining their condition with regard to maturity. For example, a female obtained on July 23, measuring $13\frac{3}{4}$ ins. was from all appearances immature, while others, very much smaller, were obtained during the summer with opaque ova. It will be seen that a dab was caught which had been feeding on young sand-eels, and another which had a much digested fish in her stomach.

The food of a group of ten anglers caught on 2nd July was: 4, empty; 1, whiting; 1, plaice; 1, plaice and sand-eel; 2, weevers; 1, flat fish. A 16 in. angler got on 9th July was found which had fed on 3 gurnards and a dab. On 16th July, the anglers were feeding on sand-eels, dabs in two instances, and haddocks in one example.

A mackerel, got by the line on August 20, measured 17 inches, weighed 1 lb. 10 ozs.; it was a male, and had been feeding on sand-eels.

We may add to this that Mr. Dent observed that the sea trout he caught this season were feeding on sprats and sand-eels for the most part.

TABLE VI.—PLAICE.

Date and Place.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	In.	Oz.					
June 28th ...	12	13					
(Cambois)	12	14					
	12	14					
	10	8					
	7	3					
	8	4					
	6	2					
	14 × 8	19	F.	—	1½	*Tellina tenuis*	.....
	11 × 6½	9	M.		[illegible]	Empty	.....
	9½ × 5	5½	F.	—	¾	Young Sand-eels	.....
July 2nd ...	11½ × 8½	24?	F.		?	Empty	Weighing difficu
(Cambois)	11½ × 7	9	M.	—	[illegible]	Tubes of Annelids and *Tellina tenuis*	owing to Se ... ..
	10¾ × 6	7	M.	—	½	Empty	.....
July 9th ...	14 × 8½	19	M.	—	[illegible]	*Tellina tenuis*	.. ...
(Alnmouth)	11½ × 6½	10	M.	—	[illegible]	Young Sand-eels	.. ...
	10 × 6	7	F.	—	1	Syphon of Solen?	.. ...
July 16th ...	14 × 8½	19	F.	—	1½	Empty	.....
(Druridge)	21 × 12	64½	F.	+	4½	*Donax trunculus*	.....
	12½ × 7½	14	F.	—	1	Empty	.....
July 23rd ...	15½ × 8¾	22	F.	—	2	Empty	Weighing difficu
(Cambois)	12¾ × 7½	12	F.	—	1½	.. ..	.....
	12 × 7	10	F.	—	1	*Tellina tenuis*	.....
July 30th ...	14 × 8	17	M.	—	¾	Annelid	.....
(Alnmouth)	13½ × 7½	16	F.	—	1¼	*Tellina tenuis*	.....
	11¼ × 6½	9	F.	—	1	Empty	.....
Aug. 20th ...	14¾ × 8½	23¼	F.	+	2½	Sand-eels	.....
(Druridge)	14 × 8	19	F.		1½	Empty	.....
	13 × 7½	14	F.	—	1½	.. ..	... ..
	18½ × 11	45					
	16¼ × 9½	28					
Aug. 27th ...	21 × 12½	55	F.	+	5	*Tellina tenuis*	.....
(Alnmouth)	16½ × 9½	28½	M.	—	1	.. ..	.....
	13½ × 8	17½	F.	—	1¼	[illegible] and Annelid ...	... ..
Sept. 11th ...	13 × 7¾	17	M.	—	½	Annelid	Weighing difficu
(Blyth)	12¾ × 7½	13	M.	—	[illegible]	Empty	owing to se
	11 × 6	9	M.	—	[illegible]	Sand-eels and *Tellina tenuis*	.....

TABLE VI. CONTINUED.—DAB.

Date and Place.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	In.	Oz.					
June 28th ...	13	18					
(Cambois)	13	16					
	8	4					
	13 × 7½	14	F.	+	2¼	Solen and *Portunus holsatus*...	... ..
	10 × 5	6	F.	—	1¼	Spawn	Measuring 35 mm. reddish colour, large pv. space
	9 × 4½	5	F.	—	1½	*Portunus holsatus*	.....
July 2nd ...	14 × 7	14	F.	—	2	Solen	Weighing difficult
(Cambois)	12½ × 6½	11	F.	—	1½	,, ...	.....
	11 × 5½	9	F.	+	1¾	,, ...	.....
July 9th ...	12½ × 7	14	F.	+	1½	Young Sand-eels and *Portunus holsatus*	... ..
(Alnmouth)	11 × 6	7½	F.	+	2	Empty	.. ...
	9 × 4¾	5½	F.	—	⅞	,, ...	... ..
July 16th ...	13 × 7	14½	F.	—	1½	*Portunus holsatus*	.....
(Druridge)	11 × 5¾	7½	F.	—	1½	Empty	.....
	9¼ × 4¾	5	F.	—	1¼	*Portunus holsatus*	.. ...
July 23rd ...	13¾ × 7¼	15½	F.	—?	2⅜	Piece of Seaweed	No ova visible
(Cambois)	10½ × 5½	7	F.	—	1⅜	Small Solen	Weighing difficult
	9¾ × 5	5	F.	—	¾	Empty	.....
July 30th ...	12¼ × 6¾	11	F.	—	1¼	Solen	.. ...
(Alnmouth)	11 × 5¾	8	F.	—	1	Empty	... ..
	9½ × 4¾	5	F.	—	1⅛	Annelid...	... ..
Aug. 20th ...	13¼ × 7½	18	F.	—	1¾	*Portunus holsatus*	.....
(Druridge)	11 + 5½	8	F.	—	1¼	Empty	.....
	9 × 4½	4½	M.	+	½	,, ...	.....
Aug. 27th ...	13 × 6¾	14	F.	—	1⅞	Solen	.....
(Alnmouth)	10¼ × 5¼	7	F.	—	1	Empty	.....
	9 × 4¾	5½	F.	—	⅜	Much digested Fish	.....
Sept. 11th ...	12¾ × 6¾	13	F.	—	1⅜	Empty	.....
(Blyth)	10⅓ × 5½	8	F.	—	1⅜	,, ...	Weighing difficult
	9¼ × 4¾	7	F.	—	⅞	,, ...	.....

Table VI. Continued.—SOLE.

Date and Place.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	In.	Oz.					
June 28th ...	8	4					
(Cambois)	$9\frac{1}{2} \times 3$	5	F.	—	2	Empty	.....
	$9 \times 3\frac{1}{4}$	$4\frac{1}{2}$	M.	—	$\frac{1}{4}$	Five young Sand-eels... ...	.....
	$8\frac{3}{4} \times 3$	5	F.	—	$1\frac{1}{4}$	Empty	.....
July 2nd ...	$11\frac{1}{2} \times 4\frac{1}{2}$	8	F.	—	$1\frac{1}{2}$	Empty	.....
(Cambois)	$11\frac{1}{2} \times 4$	7	F.	—	3	,, ...	Weighing difficult
July 9th ...	13×6	$14\frac{1}{2}$	F.	+	$3\frac{1}{4}$	Empty	.....
(Alnmouth)	$12 \times 4\frac{3}{4}$	9	F.	—	2	,, ...	.....
July 16th ...	$15\frac{1}{2} \times 7$	$22\frac{1}{2}$	F.	+	$7\frac{1}{2}$	Empty	.....
(Druridge)	$14\frac{1}{4} \times 6$	16	F.	+	$3\frac{3}{4}$	,, ...	.....
	$11\frac{1}{4} \times 4\frac{3}{4}$	$8\frac{1}{2}$	F.	—	$2\frac{1}{4}$	Sand-eel	Ovary very red
July 23rd ...	$13 \times 5\frac{1}{2}$	12	F.	—	3	Empty	Ovary reddish
(Cambois)	$14\frac{3}{4} \times 6$	17	F.	+	5	,, ...	Weighing difficult
	$10\frac{3}{4} \times 4$	5	F.	—	$1\frac{3}{4}$	,, ...	,, ...
July 30th ...	$13\frac{3}{4} \times 5\frac{3}{4}$	15	F.	+	$4\frac{1}{2}$	Empty	.....
(Alnmouth)	$11\frac{3}{4} \times 4\frac{1}{2}$	10	F.	—	$3\frac{1}{2}$	,, ...	.....
	$11 \times 4\frac{1}{2}$	7	M.	—	$\frac{3}{4}$	,, ...	.....
Aug. 20th ...	$18\frac{3}{4} \times 7\frac{1}{2}$	$34\frac{1}{2}$	F.	+	8	Young Sand eels	.....
(Druridge)	16×7	$24\frac{1}{2}$	F.	+	$7\frac{1}{4}$	Empty	.....
	$12\frac{1}{4} \times 5$	11	F.	—	$2\frac{1}{2}$	,, ...	.....
Aug. 27th ...	13×5	13	F.	—	$2\frac{1}{2}$	Small Sand-eels	.....
(Alnmouth)	$11\frac{3}{4} \times 4\frac{3}{4}$	9	F.	—	3	Empty	.....
	$10\frac{3}{4} \times 4\frac{1}{4}$	8	F.	—	2	,, ...	.....
Sept. 11th ...	$18\frac{1}{4} \times 8$	38	F.	+	8	Empty	.....
(Blyth)	$16\frac{1}{2} \times 6\frac{1}{4}$	26	F.	+	7	Sand-eels	Weighing difficult
	$13 \times 5\frac{1}{4}$	14	F.	—	3	Empty	.....

Table VI. Continued.—TURBOT.

Date and Place.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
June 28th ... (Cambois)	In. 14 × 11	Oz. 40	F.	+?	2	Empty	.....
July 2nd ... (Cambois)	14½ × 11	41	M.	—?	1	Small Sand-eels	Weighing difficult
July 9th ... (Alnmouth)	15 × 11¾	46	M.	+	1½	Empty	.....
July 16th ... (Druridge)	17 × 12	62½	F.	+	2	Sand-eel	.....
	13 × 9½	27½	M.	—?	⅞	2¾ in. Herring and young Sand-eels	.. ...
July 30th ... (Alnmouth)	18¼ × 12¾	82	M.	+	2	Empty	.....
	14 × 10½	35	F.	—	2½	Sand-eels	.....
July 30th ... (Skate Roads)	10 × 7	11	M.	—	½	Young Sand-eels	.....
Aug. 20th ... (Druridge)	12 × 9	24½	M.	—	⅞	Sand-eels	.....
	12 × 9¼	23½	M.	—	⅞	Sand-eels and young Herring	... ..
	11½ × 8½	19	M.	—	¾	Sand-eels	.....
Aug. 27th ... (Alnmouth)	14 × 10¾	39	M.	—	1¼	Empty	.....
	11¾ × 8¾	23	F.	—	1¼	Young Sand-eels	.....
	10¼ × 7¼	15	M.	—	⅛	Empty	.....

BRILL.

July 30th ... (Skate Roads)	12¼ × 8	19	M.	—	⅞	Young Sand-eels	.....
Aug. 27th ... (Alnmouth)	11¾ × 7¾	18	F.	—	1¼	Seven Sprats	... ..

FLOUNDER.

July 23rd ... (Cambois)	10 × 5	5	F.	—	⅜	Empty	Weighing difficult
	8 × 4½	3	F.	—	1⅛	,, ...	.....
	7¾ × 3¾	2	F.	—	1	,, ...	.....
Aug. 20th ... (Druridge)	13¾ × 7	16½	F.	—	1½	*Portunus holsatus*	.. ...
	11½ × 6¼	12	F.	—	1¼	Empty	.....
	10 × 5	7	M.	—	½	,, ...	.....
Aug. 27th ... (Alnmouth)	14 × 7¼	20	F.	+	2¾	Empty	Eyes on right side
	11 × 5¾	9	M.	—	⅜	*Tellina tenuis*	Eyes on left side
	10 × 6	8	F.	—	1½	Empty	,, ,,

TABLE VI. CONTINUED.—GURNARD.

Date and Place.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	In.	Oz.					
ne 28th ...	9	4					
(Cambois)	14	11	F.	+	2½	*Portunus holsatus*	.....
	12¼	10	F.	+	2	*Crangon vulgaris*	... ..
ly 9th ...	12	8	F.	+	1½	Sand-eels (young)	.....
Alnmouth)	10½	6	F.	+	1¼	,, ,, ...	... ..
ly 16th ...	12	8	F.	+		Sand-eel	... ..
(Druridge)	11	6	F.	+		,, ...	.....
	9¾	4	F.	+		,, ...	... ..
ly 23rd ...	14	14	F.	+		Sand-eels and Shrimp ...	.....
(Cambois)	11½	7	F.	+		Young Sand-eels	Weighing difficult
	9¾	5	F.	+		Empty	.....
ly 30th ...	15	17	F.	+	3½	Empty	... ..
Alnmouth)	14	14	F.	+		*Portunus holsatus*	.....
	10½	6	F.	+		Empty	.....
	—	—	—	—	—	Sand-eels and young Herring	.....
g. 20th ...	16¾	19	F.	+	2¾	*Portunus holsatus* & Sand-eels	.....
(Druridge)	14½	14	F.	+	2½	,, ,, ,,	.....
g. 27th ...	12½	11	F.	+	1¾	Young Sand-eels	.....
Alnmouth)	11	7½	F.	+	1⅝	,, ,, ...	.....

LEMON DAB.

ne 28th ... (Cambois)	10½ × 5¼	8	F.	—	1¾	Empty	.....

HADDOCK.

ot. 11th ... (Blyth)	11	9½				Sand-eels	Weighing difficult

COD.

ot. 11th (Blyth)	13	14				Sand-eel and Shrimp	Weighing difficult

BIOLOGICAL INVESTIGATIONS.

The general nature of the surface and mid-water life obtained at the trawling excursions is shown in table VII. The bottom net was, as before, attached to the beam of the trawl unless otherwise stated.

TABLE VII.

Place and Date.	Temp.	Apparatus and Quantity.	Organisms.
June 28 ... Cambois Bay		Surface net for 1 hour 3 c.c.	Ova : Weever ** Pleurobrachia *Phiallidium variabile* Megalopa Cladocera.** Copepoda *
		Bottom net for 1 hour 4 c.c.	
July 16 ... Druridge Bay		Surface net for 1 hour 10 mins. 2·5 c.c.	Ova : Weever.* Five-bearded Rockling * Dab *** Beroe.*** Pelagia *** *Phiallidium variabile* ** Zoea and Megalopa Copepoda.*** Cladocera ** *Parathemisto oblivia* Paratylus *
		Bottom net 1 hour 10 mins. 1 c.c.	*Phiallidium variabile* ** Pelagia ** Copepoda.*** Cladocera * *Parathemisto oblivia* 1 *Paratylus uncinatus* 1
		Bottom net on ground	*Paratylus uncinatus* *Pseudocuma cercaria*
July 23 ... Cambois Bay	Water 53 Air 57	Surface net 1 hour 1 c.c.	Ova : Weever (3) Dinoflagellates * Lesueria * Phiallidium ** Copepoda.* Cladocera ** Larvæ ** Mollusca Crustacea. Cirriped Nauplii, &c. Echinoderms. Plutei
		Bottom net 1 hour 10 mins. 3 c.c.	Much suspended dead material, particles of weed and cast cuticles of Crustacea, including those of *Paratylus uncinatus* Copepoda.*** Cladocera * *Pseudocuma cercaria* Larvæ : Mollusca Crustacea Echinoderms, including young Brittle Star

TABLE VII.—CONTINUED.

Place and Date.	Temp.	Apparatus and Quantity.	Organisms.
July 29 ... Doctor's Bank 7 miles N.E. of Longstone (herring fishing ground)		Surface net hanging in water for 3 hours during the night	OVA : Dab * *Ceratium tripos* * Copepoda.*** Cladocera ** *Parathemisto oblivia* jv. 1 *Guernia coalita*, several
July 30 ... Alnmouth Bay	Water 53°	Surface net ½ hour 2 c.c.	OVA : Weever.* Five bearded Rockling Phiallidium ** Pleurobrachia *** Copepoda ** *Parathemisto oblivia* jv. 1 LARVÆ : Mollusca Echinoderms Pluteus stage of Ophiuroidea Sagitta
		Bottom net ½ hour ½ c.c.	Phiallidium * Pleurobrachia * Copepoda * LARVÆ : Crustacea Mollusca **
Aug. 20 ... Druridge Bay	Water 54 Air 59	Surface net 3 c.c.	OVA : Weever. Five-bearded Rockling Copepoda.*** Cladocera ** LARVÆ : Veligers
		Bottom net 2 c.c.	Copepoda.*** Young Amphipod LARVÆ : Veligers
Aug. 27 ... Alnmouth Bay	Water 54 Air 59	Bottom net ½ c.c.	*Ceratium tripos* * Copepoda ** LARVÆ : Cyphonautes Veligers and young Gasteropoda
July 25 ... (Northumberland Coast Club.) 4 miles off St. Mary's Island.		Surface net Steamer drifting 1 hour 10 c.c.	Ceratium Copepoda.** Cladocera Sagitta Appendicularia *** LARVÆ : Cyphonautes Plutei Nauplii Mollusca

The surface and mid-water life further out was investigated this season as well as last. It did not differ materially from the conditions found nearer the coast, but as usual there was a large quantity of dinoflagellates, mainly *Ceratium tripos*, in addition to the Copepoda, Cladocera, larvæ, &c. The results will be reported upon in another place.

CRABS AND LOBSTERS.

Tables are once more submitted showing the catches of crabs and lobsters made during the season of 1902, by Mr. J. Douglas, Beadnell, and Mr. G. Fawcus, Sea Houses.

TABLES SHOWING THE CATCHES OF CRABS AND LOBSTERS FOR 1902.

TABLE I.—BY MR. J. DOUGLAS, BEADNELL.

CRABS—1902.

	January.	February.	March.	April.	May.	June.
Depth in Fathoms ...	... 28 ...	... 28 ...	... 20 ...	... 16 ...	.. 10 ...	3 to 10
No. of Pots ...	... 100 ...	... 100 ...	... 150 ..	... 250 ...	... 250 ...	... 250
Dates.	Numbers.	Numbers.	Numbers.	Numbers.	Numbers.	Numbers.
1st ...	200	80	80	130	50	...
2nd ...	200	...	...	160	228	120
3rd ...	200	...	60	78	100	78
4th ...	240	240	...	40	...	80
5th ...	...	300	40	78	...	100
6th ...	...	...	...	...	200	200
7th ...	700	260	...	148	78	...
8th ...	500	...	60	168	130	...
9th ...	240	...	...	160	100	...
10th ...	600	...	40	120	268	...
11th ...	500	300	...	122	...	87
12th ...	...	...	...	...	120	128
13th ...	...	...	80	...	...	100
14th ...	...	190	...	130	...	112
15th ...	600	...	80	168	230	...
16th ...	400	...	...	400	187	120
17th ...	300	100	100	450	...	..
18th ...	600	...	...	228	...	80
19th ...	...	20	100	180	...	164
20th ...	500	10	...	...	...	...
21st ...	200	40	80	378	210	100
22nd ...	300	...	20	...	460	...
23rd ...	500	...	...	400	228	128
24th ...	...	...	200	368	112	70
25th ...	260	...	...	240	...	86
26th ...	...	...	200	112	120	...
27th ...	...	...	100	...	100	120
28th ...	...	...	...	320	120	26
29th ...	...	...	200	120	68	...
30th ...	...	...	...	78	100	...
31st ...	400	...	360	...	...	...
	Days. Numbers.	Days. Numbers.	Days. Numbers	Days. Numbers	Days. Numbers	Days. Numbe
TOTALS ...	19 7,440	10 1,540	16 1,800	24 4,776	20 3,209	18 1,89
Average per day ...	392	154	112	199	160	105

TABLE I.—Continued.

LOBSTERS—1902.

	April.	May.	June.
Number of Pots	250	250	250
Dates.	Numbers.	Numbers.	Numbers.
1st	5	12	...
2nd	3	10	3
3rd	6	14	7
4th	3	...	8
5th	9	...	9
6th	...	4	8
7th	9	4	...
8th	13	1	...
9th	11	2	...
10th	16	1	...
11th	8	...	1
12th	...	6	2
13th	...	...	...
14th	10	..	2
15th	6	11	...
16th	8	7	2
17th	6	...	...
18th	3	...	...
19th	3	...	1
20th	...	...	...
21st	8	2	4
22nd	...	6	...
23rd	6	7	1
24th	7	...	8
25th	6	11	7
26th	8	23	...
27th	...	27	4
28th	14	30	3
29th	18	35	...
30th	12	34	...
31st	...	...	...
	Days. Numbers.	Days. Numbers.	Days. Numbers.
Totals	24 198	20 247	18 70
Average per day	8	12	4
Number of Berried Hens ...	12	28	16
Number of Small returned ...	15	45	18

TABLE II.—By Mr. G. FAWCUS, Sea Houses.

CRABS—1902.

Date.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Hens.	Total Number of Hard.	Number of Soft.	Depth in Fathoms.
Mar. 17	33	18	12	...	30	3	16
18	66	30	20	...	50	2	14 to 16
20	66	18	10	...	28	...	,,
24	98	60	40	...	100	...	16
26	98	50	30	...	80	2	,,
28	98	50	40	1	91	...	,,
29	98	46	53	...	99	...	,,
31	98	48	56	...	104	...	,,
8 days	...	320	262	1	582	7	...
Average	per day	40	33	...	73	1	...
April 1	121	55	30	...	85	1	16
3	121	43	32	...	75	...	,,
4	121	25	20	...	45	...	,,
5	121	38	22	...	60	...	,,
7	121	80	60	1	141	...	,,
8	121	64	42	...	106	...	,,
9	121	57	41	...	98	...	,,
10	121	56	42	,,	98	1	,,
11	98	28	21	...	49	...	,,
14	121	82	94	...	176	1	12 to 16
15	121	150	200	...	350	2	,,
16	121	154	143	...	297	...	,,
18	121	86	80	...	166	2	,,
21	121	94	100	...	194	...	,,
22	121	74	86	1	161	...	,,
23	121	50	40	1	91	2	,,
25	121	60	70	...	130	...	,,
26	121	42	35	1	78	...	,,
28	121	106	110	...	216	1	,,
29	121	52	45	...	97	...	,,
30	121	16	14	...	30	1	,,
21 days	...	1412	1327	4	2743	11	...
Average	per day	67	63	...	130	0·5	...

CRABS.

Date.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Hens.	Total Number of Hard.	Number of Soft.	Depth in Fathoms.
May 3	121	98	106	...	204	1	12 to 18
7	121	115	95	1	211	...	8 to 16
8	121	94	71	...	165	1	,,
10	121	75	62	...	137	...	,,
14	121	103	86	1	190	...	,,
15	121	42	36	1	79	...	,,
16	121	51	43	...	94	...	,,
17	121	26	24	...	50	1	,,
21	121	104	82	...	186	...	,,
22	121	27	29	...	56	...	,,
23	121	21	24	...	45	...	,,
24	121	42	53	2	97	...	,,
26	121	70	60	...	130	1	4 to 18
27	121	52	47	...	99	...	,,
29	121	22	18	2	42	...	,,
30	121	31	27	...	58	...	,,
16 days	...	973	863	7	1843	4	...
Average	per day	61	54		115	0·25	...
June 2	121	80	70	2	152	...	4 to 18
3	121	94	106	1	201	...	,,
5	121	40	50	...	90	...	,,
6	121	16	17	1	34	...	,,
9	121	80	70	1	151	...	4 to 12
11	121	40	50	...	90	...	,,
12	121	30	24	1	55	...	,,
13	121	18	21	...	39	...	,,
18	121	85	74	2	161	1	,,
19	121	42	47	...	89	...	,,
21	56	21	24	1	46	...	,,
23	121	43	45	...	88	1	,,
24	121	52	31	1	84	...	,,
25	121	20	18	...	38	...	,,
30	60	28	34	...	62	...	,,
15 days	...	689	681	10	1380	2	...
Average	per day	46	45	...	92	0·1	...

CRABS.

Date.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Hens.	Total Number of Hard.	Number of Soft.	Depth in Fathoms.
July 1	60	46	39	...	85	1	4 to 12
2	60	52	41	1	94	...	8 to 18
3	60	45	52	...	97	1	,,
5	80	56	43	...	99	...	8 to 28
7	100	76	84	...	160	2	,,
8	100	47	53	1	101	...	,,
9	100	26	28	...	54	1	,,
10	100	47	36	...	83	...	,,
12	100	70	80	...	150	...	,,
15	100	92	46	1	139	3	8 to 22
16	100	54	38	...	92	2	,,
17	100	63	42	...	105	4	,,
18	100	74	52	...	126	2	,,
21	100	123	97	...	220	6	,,
22	100	84	81	...	165	5	,,
23	100	71	65	...	136	...	,,
24	100	84	62	...	146	4	,,
26	100	73	51	...	124	7	,,
28	100	96	42	...	138	...	,,
29	100	84	20	1	105	4	,,
30	100	76	21	...	97	4	,,
31	100	81	26	...	107	5	,,
22 days	...	1520	1099	4	2623	57	...
Average	per day	69	50	...	119	2·3	...
Aug. 1	100	31	73	1	105	5	8 to 22
2	100	18	65	...	83	2	,,
4	100	40	80	...	120	10	8 to 28
5	100	34	66	...	100	15	,,
6	100	60	100	...	160	10	,,
7	100	52	108	...	160	5	,,
8	100	41	96	...	137	12	,,
9	100	30	85	...	115	20	,,
11	100	40	90	...	130	10	,,
13	100	30	120	...	150	15	,,
14	100	20	156	...	176	20	,,
15	100	28	142	...	170	30	,,
16	100	18	100	...	118	18	,,
18	100	16	86	...	102	20	,,
19	100	23	74	...	97	10	,,
20	100	20	50	...	70	18	,,
21	100	28	64	...	92	23	,,
22	100	16	73	...	89	12	,,
18 days	...	545	1628	1	2174	255	...
Average	per day	30	90	...	120	14	...
Sept. 18	90	16	45	...	61	23	8 to 28
19	90	26	48	...	74	60	,,
20	90	21	63	...	84	70	,,
3 days	...	63	156	...	219	153	,,
Average	per day	21	52	...	73	51	...

LOBSTERS.

Date.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Hens.	Total Number.	Depth in Fathoms.
March 18	66	2	..	...	2	14 to 16
24	98	2	1	...	3	16
26	98	1	...	...	1	,,
8 days ...	...	5	1	...	6	...
April 8	121	1	...	...	1	16
10	121	1	...	1	2	,,
14	121	...	...	1	1	12 to 16
16	121	...	...	1	1	,,
18	121	1	...	...	1	,,
25	121	...	1	..	1	,,
6 days...	...	3	1	3	7	...
May 8	121	1	1	...	2	8 to 16
10	121	2	1	...	3	,,
14	121	3	4	...	7	,,
15	121	2	3	1	6	4 to 16
16	121	1	3	..	4	,,
17	121	4	3	2	9	,,
21	121	2	1	1	4	,,
22	121	3	2	...	5	,,
23	121	2	1	1	4	,,
24	121	3	2	1	6	,,
26	121	1	1	...	2	,,
27	121	2	3	1	6	4 to 18
29	121	1	1	...	2	,,
30	121	3	2	1	6	,,
14 days ..	...	30	28	8	66	...
June 2	121	2	1	1	4	4 to 18
3	121	1	3	1	5	,,
5	121	3	3	...	6	,,
6	121	2	3	...	5	,,
9	121	2	2	1	5	4 to 12
11	121	1	1	...	2	,,
12	121	3	2	1	6	,,
13	121	2	1	1	4	,,
18	121	1	2	...	3	,,
19	121	2	1	1	4	,,
21	56	1	...	...	1	,,
23	121	3	...	1	4	,,
24	121	1	1	...	2	,,
25	121	...	2	...	2	,,
14 days ...	...	24	22	7	53	...

LOBSTERS.

Date.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Hens.	Total Number.	Depth in Fathoms.
July 3	60	1	...	...	1	8 to 18
8	100	2	...	...	2	,,
10	100	...	1	...	1	,,
15	100	...	2	...	2	8 to 22
17	100	1	...	...	1	,,
21	100	...	1	...	1	,,
25	100	2	..	...	2	,,
29	100	1	...	...	1	,,
31	100	...	2	...	2	,,
9 days ...	...	7	6	...	13	...
Aug. 7	100	1	...	1	2	8 to 28
14	100	1	...	...	1	,,
19	100	...	...	1	1	,,
22	100	...	...	1	1	,,
4 days ...	...	2	...	3	5	...
Sept. 19	90	1	...	...	1	8 to 28
20	90	1	...	1	2	,,
2 days ...	...	2	...	1	3	...

It will be observed that Mr. Fawcus has this year contributed returns for the months of August and September, and the increase shown in the proportional numbers of soft crabs is of great interest and importance. To these figures we are able to add the following, obtained at Beadnell on 27th November. In our presence 20 crab pots were hauled, and they contained 62 soft and 32 hard crabs—a proportion of 66 per cent. soft crabs.

With regard to the question as to whether the soft crabs float when they are returned to the water, we have to state that on 6th November we received 6 soft crabs from Mr. J. Douglas, Beadnell, and on putting them into a tank, three floated (males) and three sank (two males, one female.)

THE MIGRATIONS OF LOBSTERS.

It is seldom that lobsters are caught in deep water even in the winter months. One or two are sometimes caught in the crab pots off Beadnell in 25 to 30 fathoms during January and February, but when the crab pots are moved shoreward to 8 to 20 fathoms in March and April, lobsters are caught in larger numbers. From May to autumn the lobsters are captured close to the rocks. In the report for 1900, the tables contributed by Mr. Douglas, Beadnell, show that in 1899, during April, 236 lobsters were captured in from 8 to 18 fathoms, and during May and June, 419 lobsters in 6 to 14 fathoms; in 1900, 715 lobsters were got in 6 to 14 fathoms during April, May, and June. The tables furnished by Mr. Fawcus similarly indicate that off Sea Houses lobsters are caught during February and March in 8 to 18 fathoms, during April and May from 7 to 12 fathoms, and during June and July in 4 to 7 fathoms. It may be said, then, that lobsters are to be found in greatest numbers amongst and close to the rocks in very moderate depths during the summer, but even in the summer a few may be found as far out as 10 fathoms or a little more. Many more appear to go out to deeper water in the colder weather, for when fishermen have been fishing for lobsters in the winter, they have had to remove the pots a little further out than is necessary during other times of the year. Even in the winter, however, they do not migrate to the same extent as crabs. As our tables indicate, the fishermen seldom or never catch lobsters in the winter months of the year when the pots are placed 2 to 3 miles from the shore.

Nor do the lobsters appear to move very far up and down the coast. With a view to determining their migrations in this respect, Mr. Douglas kindly consented to label a number of lobsters at Beadnell. The results are given in the following Table.

MIGRATIONS OF LOBSTERS.

LIBERATED.			CAPTURED.		
Date.	Number.	Place.	Date.	Sex.	Place, &c.
April 28	10 male and female	Beach	May 17	1 male	1 mile south (3 fathoms)
			,, 29	2 males, 1 female	¼ mile east (5 fathoms)
			,, 30	2 males	2 miles north (3 fathoms)
				1 male	¼ mile east (5 fathoms)
			July 4	1 female*	½ mile east (9 fathoms)
					* liberated again on July 4, and captured Aug. 2 (see below)
April 29	10 male and female	1 mile off	July 4	1 female	In-shore
May 24	10 male and female 10 berried hens	.....	.....	.....	None caught
May 26	10 berried hens	3 miles N.E. (opposite Sea Houses)	June 5	1 female	In-shore with "berries" still present. (See page 42.)
June 5	10 male and female	Beach	July 1	1 male	In-shore
June 11	10 male and female	Beach	June 26	1 male	1 mile south (3 fathoms)
June 13	10 male and female	Beach	.....	.....	None caught
June 14	10 Male and female	Beach	.....	.....	None caught
June 16	10 male and female	In-shore	.....	.....	None caught
July 4	1 female	Beach	Aug. 2	female	½ mile east (9 fathoms)

One hundred lobsters were marked with numbered labels and liberated as stated. Of these, it will be seen that a very complete return was obtained with regard to the 10 liberated on the beach on April 28th. Eight were captured; 4 on May 29th and 30th $\frac{1}{4}$ mile out, and a female on July 4th $\frac{1}{2}$ mile out. A male went 1 mile along the shore to the south in 19 days, and 2 males had found their way evidently also along the shore 2 miles to the north in a month. The female which was caught on July 4th was liberated once more from the beach, and was captured for the third time a month later in the same place where she was got the second time, viz.:—$\frac{1}{2}$ mile out.

The female which was captured on June 5th was sent by Mr. Douglas to Cullercoats. She was put into one of the tanks, and commenced hatching early in July, finishing the process about the 14th. On the morning of 14th October she was found to have cast her "shell," and on 6th November, while still soft, she was labelled and put into the sea in Cullercoats Harbour. We hope that she may once more come into our hands. (The cast "shell" measured $11\frac{3}{4}$" and the lobster $12\frac{1}{2}$".)

It is very possible that a number of those marked moved out of the Beadnell district, and, though captured again, lost so far as the experiment is concerned, although we took care to make it as widely known as possible that the experiment was being made. Even in Beadnell, we understand that the experiment was viewed with disfavour by certain of the fishermen, who would, therefore, more than likely remove the label and destroy it.

But, on the whole, it is clear that lobsters in their adult state are quite local in their movements. The following from a letter which Mr. Douglas sent me on November 9th, 1901, confirms this view:—"Last season, I marked some berried lobsters with copper wire and put them into the sea where they were caught. One was caught this season on the same ground with no berries on her." If she had not remained on the same ground during the time she was in "berry" she had come back to it, and her migrations could not have been to any great distance. The fishermen may rest assured, therefore, that the berried lobsters which are returned to the sea remain as a rule in their own district.

CONFERENCES WITH FISHERMEN.

A conference was held at NEWTON on 1st October.

There is a good natural harbour at Newton. It can be entered in heavy weather, and tug-steamers sometimes use it. The depth at the entrance is 3 fathoms, and inside 2 fathoms, and the bottom consists of sand and clay. The men say that it could easily be made into an excellent harbour by the building of a pier on each side of the entrance. The piers would require to stand about 10 feet above the level of the rock. The one on the north side would be about 70 yards long, and the one on the south side 400 yards long. The harbour would accommodate, if this were done, some 500 herring boats, but the space could be greatly increased by continuing the wall round the shore.

At the time of the conference there were only 2 boats at the crab fishing, but 3 or 4 more would be added at the beginning of the year. Twenty-five years ago there were 14 boats engaged in this branch of the fishing industry.

Although two years ago there was no herring fishing from Newton, the good results of the last two years has led to 3 boats being employed this season, and the catches were very good.

About 25 years ago the herring fishing was a very important part of the year's work at Newton, 27 boats fishing from its harbour.

During the summer also 7 boats prosecuted the trout fishing, but the results were said not to be so good as last year. This is the more extraordinary, seeing that at neighbouring places on the coast, the trout fishing of this season was better than usual, and many more salmon were caught than in previous years. No license is required at Newton.

At Newton, as at other northern places, the lines used for various purposes are preserved, after being cutched, with tar, to which a little paraffin is sometimes added to hasten the process of drying.

The haddock fishing was, until recent years, an important branch of the work. The ground visited was about 6 miles off, and 25 years ago 20 to 30 stones of fish—principally haddocks—were obtained with 3 lines of 1,200 hooks each. The fishing is now done much closer in-shore, and 3 or 4 stones of codlings, with a few haddocks, brassies, and whitings are landed on the average.

Turbot fishing with brat nets was also very successful in the past. The custom was to leave the nets out all night, and 8 to 40 turbot were got with a fleet of 12 nets. The men say this kind of fishing is now impossible because the nets would be destroyed by the trawlers.

There are at present about 20 men engaged in the fishing industry at Newton, but about half go to work in the quarries in the latter part of the year. There used to be about 50 fishermen, and the decrease is due to many giving up fishing and going to work in Newcastle and elsewhere.

A conference was held at Boulmer on 2nd October, Mr. Stephenson in the chair. A statement has already been made with regard to Boulmer (see report for 1900). The men complained that the ground to the north side of the Coquet is, especially during December, January, and February, much fished over by trawlers. The Boulmer men are in the habit of fishing 1½ to 2 miles off for codlings, with good results. They catch very few haddocks. This, they say, is because the trawlers catch them on the ground above mentioned. They also fish in Ahmouth Bay for plaice, dab, turbot, and soles. The line fishing is prosecuted more or less from October to the beginning of March. Crab fishing takes place from February to June, and is as a rule very successful. The crab pots in the early part of the season are sometimes placed at or even beyond 3 miles out, and are, therefore, liable to destruction by trawlers. Such destruction has in fact taken place, and the men say that to obtain compensation is impossible. While on the subject of complaint, the fishermen said that French fishermen often rob the crab pots, and even destroy them by ripping them open to get at the contents, and they added that the practice was getting more common.

There were 10 boats employed at the crab fishing and 8 boats at the lines. The men, not fishing with the lines, went to work in the quarries usually.

The salmon and trout fishing was very successful. The fishermen have, in addition to a license of £5 payable to the Coquet Conservancy, to make a manorial payment. The young fishermen, moreover, those not householders, that is to say, have to pay to the landowner £1 5s. each.

At Berwick, Mr. Buglass informed us that 5 cobles were engaged this year from February to the end of May fishing with the great lines from 3½ to 7 miles out, and got good results, the

catches of ling being especially large. The general results with regard to cod and haddock for the season are given in the following table, for which I have to thank Mr. Buglass.

	1901.		1902.	
	Cod Cwts.	Haddock Cwts.	Cod Cwts.	Haddock Cwts.
January ...	843	253	1,742	158
February ...	749	244	1,155	357
March ...	228	21	924	76
April ...	216	15	219	48
May ...	218	129	144	63
June ...	100	66	60	37
July ...	84	46	44	18
August ...	49	49	58	18
	2,487	814	4,346	775

The haddocks, unfortunately, continue to show a decrease, due doubtless to some extent to the fact that the lines are used for the most part on the "hard ground," but the quantity of cod landed is almost double that of 1901.

The crab fishing from January to May was also much above the average.

The salmon and trout fishing was very good, and will likewise show an increase.

The herring fishing, as at other places on the coast, was an extremely successful one.

The Berwick and Spittal boats were at the time of our visit (September 30th) engaged in line fishing, but mussels were said to be scarce.

The season has thus on the whole been a most successful one, and statements to that effect were got from other places visited this year (Holy Island, Sea Houses, Beadnell). It is a pity that the fishermen even in the same village are so jealous of one another. In their fishing and in the selling of the fish, they lose a great deal just because of this. If every village were to adopt some sort of co-operation, the men could at all events secure better prices in the markets and save greatly in carriage by sending their catches in bulk. An educated fisherman would in each place be very useful in transacting their business, and would well deserve his share in the profits even if he did nothing else. Such an association of fishermen could make up their own rules as to local times of fishing, or at least speak as one man with regard to any change they desire in the bye-laws for regulating the fisheries.

SCIENTIFIC FISHERY WORK ON THE EAST COAST.

The report, with minutes of evidence of the Committee "appointed to enquire and report as to the best means by which the State or Local Authorities can assist Scientific Research as applied to problems affecting the Fisheries of Great Britain and Ireland," comes to our hands just as our report is passing through the press. It is important with reference to the work which we have been carrying on in this district, and we beg to offer a few remarks upon it.

The Committee recommend that on the South Coast of England, the investigations should be made in connection with the Plymouth Laboratory. The report shows that the Plymouth Laboratory was constructed at a cost of £12,000, of which amount the Treasury contributed £5,000. Government also makes an annual grant of £1,000, and the Laboratory receives each year from other sources £1,700. The investigations on the West Coast are to be conducted by the Lancashire and Western Fisheries Committees. They at present have a Laboratory in connection with the College at Liverpool, and, "with the assent of the Board of Trade," they expended a few years ago the "sum of £1,000 in the establishment of a lobster hatchery and Marine Station at Piel, near Barrow-in-Furness. The expenditure of a further annual sum, not exceeding £500, has been sanctioned for ten years for the maintenance and working expenses of the hatchery and its adjuncts." In both these cases the new work will be undertaken "with increased financial assistance."

On the East Coast, which the report admits is the most important of all, the Committee recommend the establishment of a laboratory, with a museum, at Grimsby. Three biological assistants will be "appointed and placed on a permanent basis" as at the other two places. Each of the three stations, moreover, is to be provided with a special steamer to carry on the investigations at sea. The report takes note of the fact that "a laboratory and Marine Station has been established at Cullercoats, in the Northumberland Sea Fisheries District, mainly owing to the assistance given by Mr. John Dent, a member of the local committee." We do not think for a moment of bringing into comparison with what has been done on

the South and West Coasts the work we have been doing with limited means and time on the East Coast. But to make the picture complete, it is only fair to state that the expenses of the trawling experiments are borne each year by Mr. Dent, and it is also owing to his generosity that we were able to establish the laboratory at Cullercoats. The Northumberland Sea Fisheries Committee bear the expense of maintenance, the upkeep of a small boat, and pay also for the spare time of a fisherman; they also provide for the publication of this annual report. A grant of £100 from the Technical Education Committee of the Northumberland County Council to the Zoological Department of the Durham College of Science is all that appears on paper as the funds at our disposal.

If we do not venture to compare our work then with what has been done elsewhere, we should certainly blush to state our resources in relation to those obtained by similar institutions in other parts of the country. As the College knows too well, the North of England has never shown much enthusiasm with regard to matters educational, or at all events, scientific, and our laboratory merely illustrates the local position. It goes without saying that, if we had been a larger body, as a going concern, with funds coming in it might be said even adequate to the work we have accomplished, the investigation of the Mid-North Sea would have been entrusted to us.

The position of affairs, even now, is not just what it was when the Committee's report was completed. A laboratory has been established since then at Lowestoft, to investigate the southern part of the North Sea in connection with the international scheme. Grimsby, it appears to us, would only represent the same area of the North Sea. And when we consider that the northern part of the North Sea is provided with the Scottish Fishery Board's Laboratory at Aberdeen, a more central position for the proposed new laboratory would be the Tyne, and from there the Mid-North Sea could be better investigated than from Grimsby. For several years we have consistently recommended that a laboratory should be established at North Shields for the purpose of investigating the problems relating to the fish and the fisheries of the North Sea with the wealth of material landed there every day by trawlers. Besides, we have a record of six years' investigations in connection with the local laboratory, and of eleven years by means of the trawling experiments, and this would form a nucleus for more extended enquiries, which it would take time at least to parallel.

THE ISOPODA OBTAINED BY DREDGING IN 1901-2.

By Prof. G. S. BRADY, D.Sc., F.R.S., &c.

The following list embraces all the Isopoda taken during the cruises of the "Stanley" in 1901 and 1902; also a few species found in collections made by Mr. Sheppard during a trip with one of the steam trawlers. The letters following the names of species refer to the various stations at which they were obtained. The list of stations is as follows. (See Chart I.)

A. 25 miles East of Ahmouth... ... 50 fathoms
B. 29 „ „ „ ... 59 „
C. 32 „ „ „ ... 40 „
D. 3 „ S.E. of station C ... 39 „
E. Surface net—night—from station D to 4 miles off Tynemouth ...
F. Souter Bank ... ... 39 „
G. 2 miles E.S.E. of F ... ... 39 „
H. 5-6 miles off Souter Point ... 30 „
J. 2½ „ „ „ ... 21 „
S A and S B. — 80 miles out (Mr. Sheppard) ... ...42 to 45 „
M. 30 miles out from Farnes ... ... 45 „

Isopoda.

Gnathia maxillaris, M. Edw., G, M.
Leptognathia brevimana, G. O. Sars, B, H.
Astacilla longicornis, Sow, J, and Sheppard's collection.
Arcturella dilatata, G. O. Sars, C, F.
Munna Kröyeri, Goodsir, D, G, H.
„ *limicola*, G. O. Sars, F, J.
Paramunna bilobata, G. O. Sars, B, F, H.
Pleurogonium inerme, G. O. Sars, F, H.
„ *rubicundum*, G. O. Sars, J.
Pseudarachna hirsuta, G. O. Sars, B, F.
Eurycope cornuta, G. O. Sars, H.
„ *mutica*, G. O. Sars, A, B, F.
Pariambus typicus, Kröyer, off Sunderland, 40 fathoms.
Janira maculosa, Leach, Sheppard's collection.
Idotea viridis, Slabber, Cullercoats, tide marks.

LIST OF ENTOMOSTRACA TAKEN BY Mr. MEEK IN HOLY ISLAND LOUGH.

By Prof. G. S. BRADY, D.Sc., F.R.S., &c.

This gathering was made on 27th June. The pond is a shallow one—the average depth is about 3 feet, and the bottom consists of soft black mud. It is to a large extent overgrown with *Equisetum limosum*, amongst which the coot and the black-headed gull nest. It gives origin to a small stream which runs close to the village, and was until recently used more or less for domestic purposes. The only fish-life obtained was the three-spined stickleback.

Cladocera—

Daphnia lacustris, G. O. Sars.
Simocephalus retulus, Müller.
Ceriodaphnia quadrangula, Müller.
Eurycercus lamellatus, Müller.
Acroperus harpæ, Baird.
Alona costata, G. O. Sars.
Pleuroxus lævis, G. O. Sars.
Chydorus sphæricus, Müller.

Ostracoda—

Cypria lævis, Müller.
,, *serena*, Koch.
Pionocypris vidua, Jurine.

Copepoda—

Cyclops serrulatus, Fischer.
,, *viridis*, Fischer.
Canthocamptus minutus, Müller.

The gatherings were made by means of a bottom net worked from a canvas boat kindly lent for the purpose by Mr. Newbigin. The proceeds consisted chiefly of *Simocephalus retulus*, all the other species with the exception of *Pionocypris vidua*, *Cyclops viridis*, and *C. serrulatus* being very poorly represented.

LITHOLOGICAL NOTES ON BOTTOMS DREDGED OFF NORTHUMBERLAND.

By Prof. G. A. LEBOUR, M.A., M.Sc., F.G.S.

The samples were collected at the dredging excursions made in 1901 and 1902, and the stations are shown in Chart I.

A.—Muddy sand. The quartzoze grains are mixed with decomposed grains of dark rock, apparently broken slaty greywacke. A good deal of fine clay is present, and a few minute grains of magnetite and of some other (non-magnetic) iron ore, probably ilmenite. Very little mica. 50 fathoms.

B.—Muddy sand, with fragments of shells. Very like A, but with additionally, some microscopic dark green grains, apparently of glauconite. 59 fathoms.

D.—Light-coloured muddy sand, quartz, felspar (plagioclase), and a little muscovite. A little magnetite in very minute grains. 39 fathoms.

F.—Sandy mud. Much mica (both Biotite and Muscovite) present. Clayey portion ferruginous, no magnetite found. 39 fathoms.

G.—Very like F, but less micaceous. 39 fathoms.

H.—Rather muddy sand. Chiefly made up of quartz grains, with a considerable admixture of clinker fragments. No magnetite. 30 fathoms.

J.—Sand only, slightly muddy, with very small pebbles of rolled igneous rock. Clinker in small fragments. 21 fathoms.

M.—Shell sand, with numerous entire shells, chiefly minute (see accompanying list by Miss M. V. Lebour). Some quartz grains, clinker fragments, and mica. Practically no mud. 42 fathoms.

N.—Shell sand, coarser than M, with larger fragments of shells and fewer entire specimens (see list). A little quartz sand, and some clinker fragments. Also one largish fragment of jasper. 52 fathoms.

On the whole all the bottoms referred to are of remarkably uniform nature. Sandy material, mixed more or less with clayey mud and clinkers. The last must have come from passing steamers, and a good deal of the darker portion of the fine muddy material may be also artificially brought in the same way. A few flints (most of them quite minute) from the chalk occurred in almost every bottom, and probably these come from ballast, and may not properly belong to the localities in which they were dredged. The boulder clay of the coast (and no doubt also beneath the sea) may have furnished the greater portion of the clayey portion of the bottoms —more, I think, than the older carboniferous shales: but this must remain a matter for surmise only, and can scarcely be asserted with confidence.

SHELLS FROM STATION M.

Punctnrella noachina, L.—One, dead.
Emarginula fissura, L.—A fragment.
Trochus sp., juvenile, perhaps T. ziziphinus, L.—Broken.
Triochotropis borealis (Brod. and Sow.)—A fragment.
Rissoa striata, J. Adams.—Several, dead.
Scalaria sp., probably Trevelyana (Leach).—Juvenile, broken.
Odostomia unidentata (Mont.)—Two, dead.
O. interstincta (Mont.)—One, dead.
Eulima bilineata, Alder.—One.
Pleurotoma Trevelyana (Turton).—One.
Defrancia linearis (Mont.)—A few, broken.
Natica sp., probably catena (Da Costa).—Fragments.
Buccinum undatum, L.—Juvenile.
Venus ovata, Penn.—Several valves, juvenile.
Astarte sulcata (Da Costa).—Several valves.
A. compressa (Mont.)—A few valves, juvenile.
Modiola modiolus, L.—Fragments of large specimen.
Cardium edule, L.—A fragment.
Saxicava rugosa, L., v. artica, L.—One valve.
Anomia ephippium, L.—A few valves.
Nucula nucleus, L.—One valve.
Crenella decussata (Mont.)—One valve.
Axinus flexuosus (Mont.)—A fragment.
Mactra solida, L., v. elliptica, Brawn.—One valve, juvenile.

SHELLS FROM STATION N.

Buccinum undatum, L.—Fragments and egg capsules.

Fusus antiquus, L.—Fragments.

Aporrhais pespelicani, L.—One, dead.

Psammobia ferroensis (Chem.)—Several broken valves.

Modiola modiolus, L.—Fragments.

Mactra solida, L., v. elliptica, Brown.—Several valves.

Astarte sulcata (Da Costa).—One, alive, juvenile; several old valves.

A. compressa (Mont.)—Several valves.

Pecten tigrinus, Müller.—Several valves.

P. opercularis, L.—Several valves.

Artemis lincta (Pult.)—A few valves.

Anomia ephippium, L.—One valve.

Cardium echinatum, L.—Several valves.

Mya truncata, L.—Several broken valves.

Cyprina islandica, L.—Several broken valves.

Montacuta substriata (Mont.)—Several.

ADDITIONS TO THE LIST OF THE MARINE MOLLUSCA OF NORTHUMBERLAND.

By MARIE V. LEBOUR.

The following shells from station M. are the only additions this year:—

Puncturella noachina, L.

One dead, but perfect specimen.

Crenella decussata (Mont.)

One valve.

Lcinus flexuosus (Mont.)

A fragment.

These are all mentioned by Alder as rare.

ON THE STRUCTURAL CHANGES ACCOMPANYING THE ECDYSIS OF THE CRAB.

By E. P. WITTEN, B.Sc., Durham College of Science, Newcastle-upon-Tyne.

At the request of Mr. Meek, I have commenced to investigate the changes which occur during the growth of the Crab and other Crustacean forms, with special reference to exuviation. The subject has attracted the attention of observers since the time of Aristotle. In this way there has gradually been accumulated a number of valuable facts relating especially to the external changes accompanying the process of ecdysis. In this preliminary account, however, I do not intend to make detailed reference to this historical side of the question. But it is impossible to approach it without mentioning that Vitzou[1], in 1882, made a very careful analysis of the ectoderm and its chitinous products discussing separately the external shell and the proctodeal and stomatodeal invaginations of the alimentary canal. But since that time little has been done in the direction of ascertaining the effect which the preparation for, and the ecdysis itself have upon the different tissues and organs.

The following notes are based on the examination of 3 soft and 3 hard crabs, 2 males and 1 female in each case. These were brought from Beadnell on November 27th, having been captured by Mr. Douglas, and some of the points which we have observed, if not showing anything new, are still interesting enough to excuse this preliminary account.

We might say that there are four main causes which lead us to expect morphological changes in the tissues of most of the arthropod forms during the process of exuviation. Firstly, the old shell must be cast off and a new one produced. Again, it is only when soft that extension of many of the tissues and organs, which have probably been growing since the last ecdysis, can take place. Thirdly, the various members have to be withdrawn from the many nooks and corners of the old shell, in some parts

1.—Vitzou. Recherches sur la structure et la formation des téguments chez les crustacés décapodes. Archives de Zool. Expér. et Général. 1882.

as, *e.g.*, in the claw through an aperture many times less than the member itself. And lastly, at all events in the higher crustacea, impregnation only takes place when the female is in the soft state. The observations which follow, being taken from so few specimens, must not be taken as conclusive, but merely as preliminary to general research.

The Shell.—The shell itself is composed of four layers, the intimate structure of which we shall not enter into at present. On the surface is a thin transparent cuticle. Beneath this is a somewhat broader layer which is deeply pigmented and gives the shell its characteristic colour. This layer can be easily scraped off the surface with a knife. The third layer is calcareous, and constitutes almost the total thickness of the shell. The fourth layer is again thin, and, like all the others, is made up of parallel lamellae. Beneath this, we find a regular layer of long cells which are much enlarged at the casting period—the ectoderm or chitinogenous layer of various authors. Beneath this layer again, we find the connective tissue, with glands, muscular fibres, vessels, and nerves. The superficial layer of the connective tissue is pigmented and constitutes the dermis. At casting, the separation takes place between the fourth layer and the ectoderm. A gelatinous mass, with no definite structure, is secreted in the intervening space. The cells of the ectoderm immediately scale off at their upper surface forming the upper layer of the new shell. The new shell is thus seen to be forming before the old one is thrown off. The cells of the dermis and ectoderm are much swollen at this period as is evidenced by the fleshy nature of the soft envelope of the crab shortly after casting. On treatment with alcoholic tincture of iodine, these cells are seen to be stored with glycogen (Cuénot[3]). After the new shell is produced, these cells degenerate till, in the hard condition, the ectodermal epithelium can scarcely be distinguished. The muscle fibres which serve for attachment pass right through the dermis and are attached to the basal membrane formed of the interlacing fibres of the lower ends of the epithelial cells. In this way we see that the muscular attachment is never really severed when the exoskeleton is thrown off.

The Blood.—On making an incision through the skin of a soft crab, an immense quantity of albuminous fluid can be withdrawn by

2.—Williamson: Contributions to the Life History of the Edible Crab. Eighteenth Annual Report of the Fishery Board for Scotland. Part III. 1900.

means of a pipette. This fluid permeates the blood spaces all over the body. It differs from the blood of a hard crab in its greater bulk and in the increase of the amœbocyte cells of the blood. It also contains extraneous cells, but these appear to have been torn away from the delicate tissues by the pressure of the pipette. The blood thus appears to be prepared quantitatively and qualitatively for the ecdysis, after which event it will gradually be reduced as the shell becomes hard. According to Cuénot[3] the corpuscles do not multiply in the blood, but are produced in a rudimentary lymphatic gland found near the anterior extremity of the ophthalmic artery. This gland appears simply to consist of an aggregation of irregular cells from the periphery of which the amœbocytes are cut off. The increase of the plasma is probably largely due to osmosis. Another class of cells seen in the blood might be mentioned in passing owing to its universal occurrence. These are the explosive cells or thrombocytes. They are the repairing agents of the blood. "exploding" when movement ceases and throwing out numerous filaments thereby forming a network or clot over any damaged vessel. The thrombocytes, however, do not appear to be able to prevent the escape of blood from an injured limb, at all events when the crabs are out of the water, for unless the limb is thrown off at the breaking joint, hard and soft crabs alike often apparently bleed to death.

Muscular Tissue.—The increase of the body-fluid appears to be accompanied by the degeneration of some of the solid tissues. The muscle fibres of the claw or abdomen still possess their characteristic transverse striations, though not nearly so well marked. In the hard condition the bands are sharp and clear. In the soft they are dull and ill-defined, the fibre becoming semi-transparent having lost the opacity formerly due to its more-solid contents. Under a little pressure the fibres lose their definition and form a jelly-like mass. Sections show the fibres contracted, probably due to their more delicate condition, and with little content compared with the corresponding state in a hard specimen. We can thus form some conception of the manner in which masses of muscular tissue can be squeezed through small apertures, as it were in an amœbiform or worm-like manner. In this way the claws, the legs and the abdomen with its flattened uropods and telson, it can be imagined, may be easily withdrawn.

3. Cuénot, Études physiologiques sur les Crustacés Décapodes. Archives de Biologie, T. XV, 1895.

Vascular and Nervous Systems.—The heart and blood-vessels are not affected to any marked extent by the change. They become slightly more transparent and flabby, the muscular fibres appearing to be somewhat relaxed. The function of the heart being continuous, we might expect that it necessarily must escape the stagnation produced in the other organs. How can this be managed? The solution appears to lie in the question of the effect of pressure on tissues and organs. Undue pressure has a degenerating effect on organs as a rule, in some cases even causing a certain amount of atrophy. The organs of the crab, growing constantly in the periods between ecdyses must exert great pressure upon one another, as is evidenced by the great expansion immediately after casting. The organs under this pressure must, therefore, be somewhat affected in their development. But the heart, lying as it does in its pericardial sac, will be able to expand in a natural manner as it develops, and may thus probably escape the pressure experienced by the other organs. Much the same thing may apply to the nervous centres, which seemed little affected. The nerves, however, were less opaque and more difficult to follow.

The Liver.—The liver is very large in the crab and occupies a large part of the thorax. It is thus very liable to modification by pressure previous to casting. The effect, however, is not so great owing to the fact that at this period the reproductive organs which lie upon it are in an unripe condition, and, consequently, allow a counterbalancing space for expansion. That the liver has increased in size is very evident. The fat cells which have an absorbing function are well stocked with matter of an excretory nature, as well as glycogenous reserve material. The larger type of fermenting cells, too, are distended. The vacuoles containing the drops of brown digestive juice are enlarged, and this excess of liquid gives the liver a browner appearance in the soft stage. The most interesting point about the liver of the soft crab is the presence of glycogen in the excretory fat cells (Cuénot[3]).

The Reproductive Organs.—The changes seen in the reproductive organs are very striking. In the female, as stated above, it is only when quite soft that impregnation can take place. The vaginae are never plugged when the crab is about to cast. Consequently, the shedding of the chitinous wall of the vaginae and spermathecae is easily performed. Immediately after this slough, the glands of the spermathecae secrete a fluid

which hardens on contact with sea-water. Probably, as Williamson thinks, the penis on each side displaces a quantity of the fluid into the vagina which on the withdrawal hardens and forms a solid plug keeping the sperms secure in the spermatheca till such time as spawning takes place. That part of the secretion which does not go to form the spermatic plug solidifies in the spermatheca.

The state of the ovaries in the soft female examined was quite characteristic. They were immature, pale white in colour, and the ova were very small showing no yolk. The following summary shows the state of the ovary in the soft females dissected by Williamson[3]—

No. of Females Examined in Soft Condition.	Appearance of Ovary.						
	Immature.	Pale White.	White.	Pale Orange.	Small.	Orange.	Not Noted.
68	19	18	13	9	1	1	7

The hard female presented on opening, a large coral-red ovary, which covered the whole upper surface of the creature. The ova were very large, and showed a large development of yolk. The spermatheeae contained a small amount of the secreted matter as well as a large quantity of sperms. The latter appeared to be held together by some cementing matter, rendering them semi-solid as a whole. The spermatic plugs had disappeared from both vaginae, the contraction of the vulvæ probably keeping out the sea water. The specimen would, without doubt, have come into spawn in a few weeks from the time of its capture.

The testes of the soft male were small and immature. In section they revealed mother-cells, but no mature sperms. The vas deferens showed no spermatophores. In the hard specimens, on the other hand, the testes were full and ripe. Sections showed that they were packed with mature sperms, ready for transmission to the vas deferens. The latter was distended with spermatophores and a few free sperms. A few adipose cells were seen also. The number of sperms in a packet was very variable, ranging from four to about as many hundreds.

ON THE GROWTH OF THE CRAB.

By A. MEEK, M.Sc.

The great length of the spawning, and, consequently, also of the hatching season in the case of fishes and of the higher crustacea, makes it very difficult to state definitely the relation of size to age. The period is often one of several months, and thus the first hatched of one season reach a size in one year which is only attained in two years or more by the later hatched. At the limits of variation, therefore, for a given age, it is not merely difficult, but indeed impossible in most cases to say to which of two years the specimens belong. This overlapping of the successive generations is shown by the fact that in a very short time, usually less than a year, examples of a species may be obtained of all sizes, from the smallest to the largest. It is thus difficult and often uncertain attempting to read the facts of growth from an analysis of such measurements. The records of growth, then, in the case of individuals kept over long periods are therefore of the greatest importance, and render the task easier and the results more definite. In the present case, I am fortunately in the position to approach the subject by first bringing under review certain details with relation to the growth of the Common Shore Crab, Green Crab, or Dog Crab,

CARCINUS MŒNAS.

They refer to the excellent series illustrating the growth of this species presented to the British Museum of Natural History, London, by H. T. Waddington, Esq. For the measurements and the dates I have to thank Dr. W. G. Ridewood. To the table I have only added columns showing the number of days intervening between each successive ecdysis (casting of the shell) and the gain made at each period. (I take it that the first date refers to the capture, and thus the first interval of days in each case must be neglected.) I have also expressed the measurements in graphic form in Chart VIII.

The shore crabs which were kept under observation by Capt. C. Du Cane* were got with ova at the end of December. The embryos began to hatch in the beginning of March, but it was only towards the end of April that they hatched in abundance.

* 1839, Ann. and Mag. Nat. Hist. vol. III., page 138.

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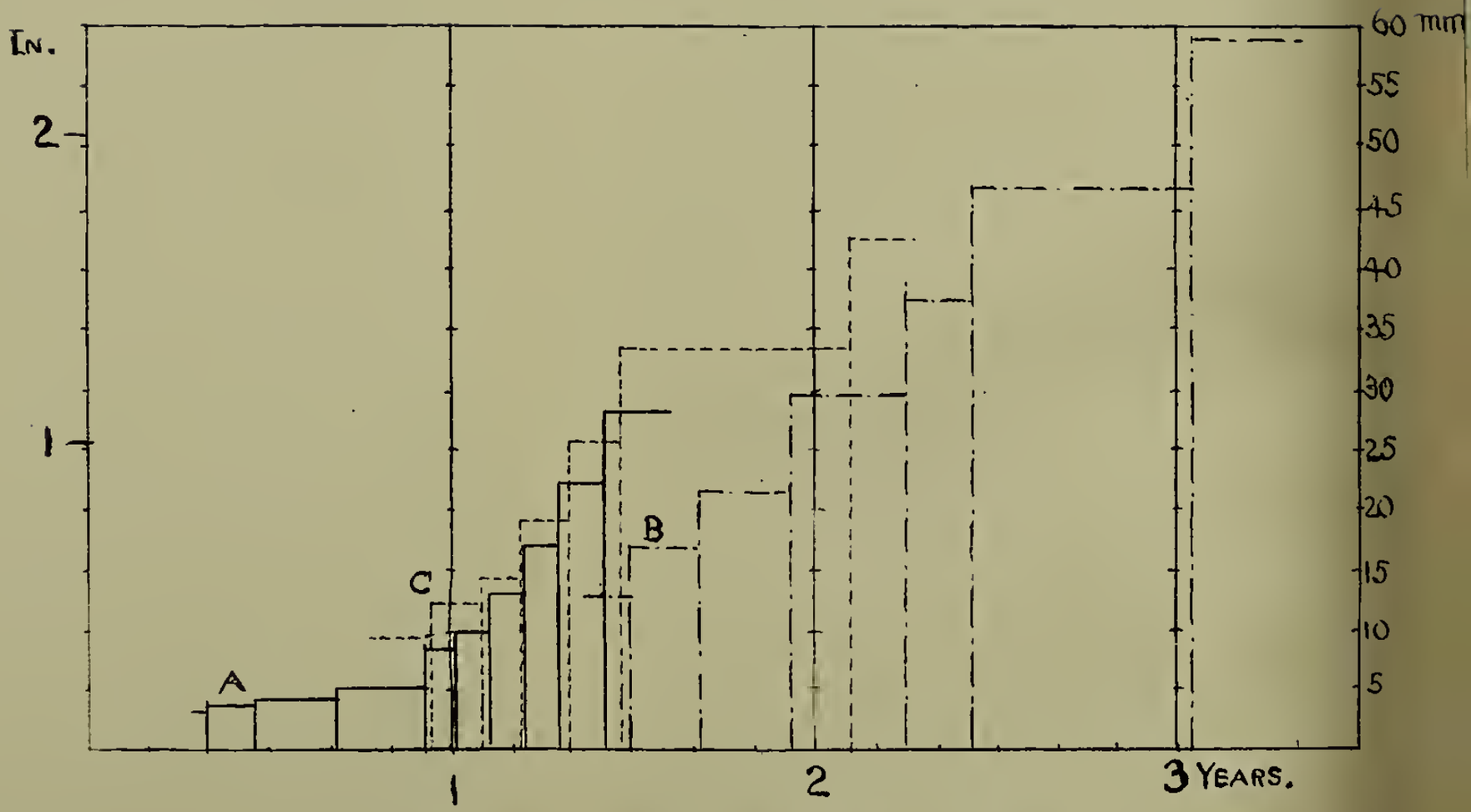

Chart VIII.—Growth of *Carcinus mœnas*. See Table I.

The hatching season may be said to be then March, April, and May, and the females are thus in "berry" for a period of at least 4 months. In constructing the Chart I have assumed the year of the crab's free life to begin on 1st May, and each of the three years represented extends therefore from 1st May to 30th April.

The growth of the crab proceeds by a number of ecdyses, which is more than likely not absolutely constant, and at each "cast" the crab makes a sudden increase in size and suffers at the same time a loss of weight representing at least the "cast-shell."

From both the Table (Table I.) prepared from the measurement of Mr. Waddington's specimens and the Chart it is clear in the first instance that in the young condition, the ecdyses occur more frequently, and that, therefore, growth is more rapid in the summer than in the winter. They show also that a gradual extension in the periods between the ecdyses, subject to this seasonal modification, takes place. Specimen A cast 8 times in a year

TABLE I.—THE COMMON SHORE CRAB—*Carcinus mœnas.*

A.					B.					C.				
Date.	Intervals in Days.	Breadth.	Rate of Increase.	Gain per Day.	Date.	Intervals in Days.	Breadth.	Rate of Increase.	Gain per Day.	Date.	Intervals in Days.	Breadth.	Rate of Increase.	Gain per Day.
1896		mm.			1896		mm.			1897		mm.		
Aug. 19	...	3	—	...	Sept. 12	...	12½	...	...	Feb. 23	...	9	...	...
,, 31	12	3½	⅛	...	Oct. 25	43	16½	3.1/1	...	April 8	44	12	⅓	...
Oct. 14	44	4	¼	·011						May 30	52	14	⅛	·038
1897					1897									
Jan. 8	86	5½	2.1/7	·017	Jan. 14	81	21	3.1/7	·056	July 10	41	18½	3.1/1	·11
April 4	86	8	2.1/2	·03	April 11	87	29½	2.1/5	·098	Aug. 31	52	25	2.1/8	·12
May 2	28	10	⅓	·07	July 30	110	37	3.1/9	·068	Oct. 19	49	33	2.1/1	·16
June 6	35	13	3.1/3	·086	Oct. 7	69	46½	3.1/9	·138	1898				
July 12	36	17	3.1/3	·11						June 7	231	42½	3.1/5	·04
Aug. 15	34	22	3.1/4	·12	1898									
Oct. 2	48	28	3.1/7	.083	May 17	222	58½	3.1/9	·054					

from 31st August, 1896, to 15th August, 1897, or 8 times from 14th October, 1896, to 2nd October, 1897. The larger and older Specimen C cast 6 times between 8th April, 1897, and 7th June, 1898. The still older Specimen B cast 5 times from 25th October, 1896, to 7th October, 1897. We know, as a matter of fact, that finally casting takes place only once a year, or once in 2 or 3 years at all events in the case of the older females, until a limit of growth is reached—a limit which is without doubt not the same for every individual.

The absolute gain at each ecdysis is, as the Chart indicates, a gradually increasing one, and the loss in weight is also greater and greater each time. But the rate of increase appears to suffer a reduction, more or less gradually, to about $\frac{1}{4}$. When equal periods are considered, it is seen that the rate of growth gradually diminishes.

A year's gain in size in the case of Specimen A from 14th October to 2nd October was 24 mms., or 6 times its breadth. Specimen B gained 30 mms. from 25th October to 7th October, not twice its breadth. We cannot compare Specimen C for the same period, but from May 30th to June 7th, it gained 28½ mms., just twice its breadth. Thus, although the absolute increase say between one and two years is greater than that during the first year, the rate of growth is actually diminished. We have to keep in mind the shifting stage of growth in judging the progress made. It is a law of growth (and the crab is no exception to it), that from or about the beginning of development growth proceeds at a gradually diminishing rate.*

The variation which may be observed in Table I. with regard to the intervals between the ecdyses and to the progress made at such periods, may be inferred to be due, apart from individual variation, to season reacting upon animals of different age, and, therefore, possessing different rates of growth.

The construction which I have put upon the measurements of Mr. Waddington's specimens is apparent in Chart VIII. I have made no attempt, here, however, to reduce the facts to a curve. But from the Chart and the knowledge which the measurements afford with regard to the progress made at each ecdysis, I have deduced the figures in Table IV.

We are fortunately not altogether without some facts from Cullercoats.

* *Vide* "The Veterinarian," 1901, p. 311.

Three males of this species which had cast their shells were measured on August 21th, 1900, at Cullercoats.

	Rate of Increase.
Original Size $\frac{1}{2}$ in. (12·7 mm.) Soft Crab $\frac{5}{8}$ in. (15·9 mm.)	$\frac{1}{4}$
Original Size $\frac{1}{2}$ in. (12·7 mm.) Soft Crab $\frac{11}{16}$ in. (17·5 mm.)	$2\frac{1}{7}$
Original Size $1\frac{1}{8}$ in. (28·6 mm.) Soft Crab $1\frac{1}{2}$ in. (38·1 mm.)	$\frac{1}{3}$

The first two specimens would come into the Chart just midway between A and B, and would be according to the scheme here adopted about 1 year 3-4 months old. The third specimen would be in the same way, 2 years 3-4 months old.

For the following table giving the results of a series of careful measurements and weighings made on the living crabs, I am indebted to a student of the Natural History Department of the College, Mr. C. N. Dodd, A.Sc.

TABLE II.—COMMON SHORE CRAB—*Carcinus mœnas.*

ate.	Breadth. In.	Breadth. Mms.	Weight Grms.	Sex.	
902					
. 28	1·4	35·5	9·8	Female	...
,,	1·2	30·4	8·1	,,	...
29	1·95	49·5	22·87	,,	...
,,	1·2	30·4	7·89	Male	...
,,	0·95	24·1	3·9	Female	...
31	1·7	43·2	21·8	,,	Berried
,,	1·6	40·6	15·9	,,	...
,,	1·5	38·1	14·0	Male	...
il 1	1·4	35·5	10·4	Female	...
,,	1·1	27·9	5·75	Male	...
,,	1·075	27·3	4·7	,,	...
,,	1·05	25·6	4·99	Female	...
4	2·95	74·9	106·65	Male	...
,,	1·55	39·4	15·5	,,	...
9	2·45	62·2	44·6	,,	...
,,	2·3	58·4	38·375	,,	...
,,	2·1	53·3	35·9	,,	...
,,	1·95	45·9	31·75	Female	...
,,	1·95	45·9	26·4	,,	...
,,	1·9	48·3	25·2	Male	...

Date.	Breadth. In.	Breadth. Mms.	Weight Grms.	Sex.	
1902 April 9	1·9	48·3	27·1	Female	Berried
,, ,,	1·9	48·3	23·25	,,	...
,, ,,	1·8	46·2	18·7	,,	...
April 9	1·75	44·4	21·3	Female	Berried
,, ,,	1·5	38·1	11·55	,,	...
,, ,,	1·45	36·8	11·9	Male	...
,, 30	2·7	68·6	85·0	Female	Berried
,, ,,	2·55	64·7	66·5	,,	,,
,, ,,	2·5	63·5	62·15	,,	,,
,, ,,	2·5	63·5	56·35	Male	...
,, ,,	2·5	63·5	63·5	Female	Berried
,, ,,	2·45	62·2	55·2	,,	,,
,, ,,	2·35	59·7	51·4	,,	,,
,, ,,	2·35	59·7	47·9	Male	...
,, ,,	2·35	59·7	39·2	Female	...
,, ,,	2·3	58·4	43·55	,,	Berried
,, ,,	2·3	58·4	41·1	,,	,,
,, ,,	2·0	50·8	35·0	,,	,,
,, ,,	1·95	49·5	30·5	Male	...

The determinations were made in about a month, and may be re-arranged as follows :—

TABLE III.—*Carcinus mœnas.*

Weight.			Size.		
M.	F.	B.	Inches.		
106·65	...	...	2·9	M	
...	...	...	2·8	...	
...	...	85·0	2·7	B	
...	...	...	2·6	...	
56·35	...	64	2·5	M B B B	
44·6	...	55·2	2·4	M B	
43·1	39·2	45·3	2·3	M M F B B B	
...	...	...	2·2	...	
35·9	...	...	2·1	M	3 years
...	...	35·0	2·0	B	
27·9	26·0	27·1	1·9	M M F F F F B	
...	18·7	...	1·8	F	
...	...	21·5	1·7	B B	
...	15·9	...	1·6	F	
14·7	11·55	...	1·5	M M F	2 years
11·9	10·1	..	1·4	M F F	
...	...	...	1·3	...	
7·89	8·1	...	1·2	M F	
5·2	...	...	1·1	M M	
...	4·99	...	1·0	F	
...	3·9	...	0·9	F	

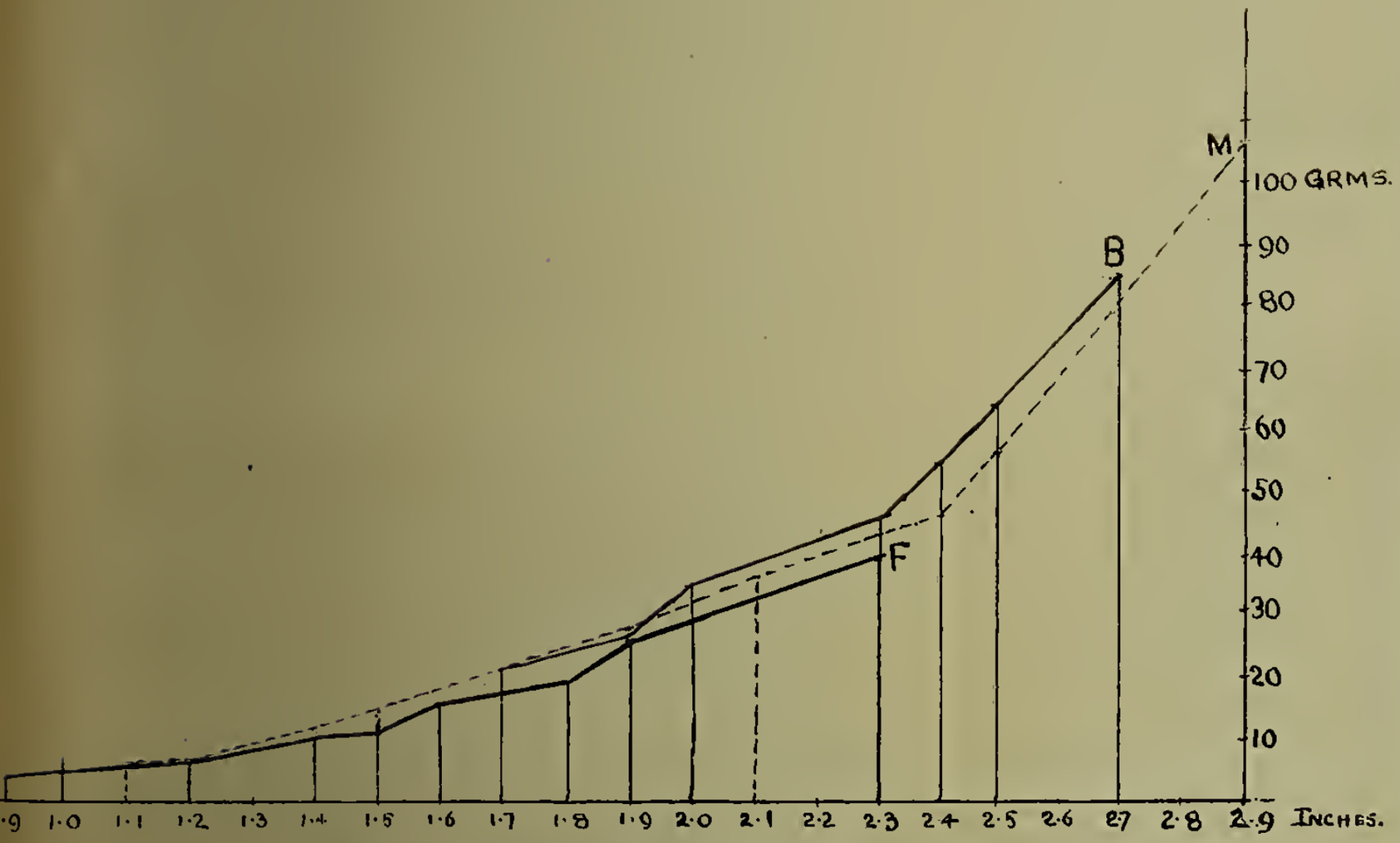

Chart IX.—Relation of Weight to Size in *Carcinus mœnas*.
See Table III.

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It is more than likely that those between 0·9 to 2·1 (24 mm. to 53 mm.) represent without reference to sex the variation in growth at the end of the second year. This would give an average of 38·5 mm. The group thus defined includes 4 "berried" females (B), but it is more than probable when we consider the size of the crab when impregnation would have occurred, that these belong to the end of the third year, which would thus include some at least of the crabs occurring between about 1·7 in. (44 mm.) and 2·5 in. (63 mm.). The average would in this case be 2·1 in. or 53 mm.

The above figures in Table III. are expressed in graphic form in Chart IX., which indicates the relations of weight to size for males, M, females, F, and berried females, B. The curve is a very interesting one corresponding closely within limits to the logarithmic curve, and shows that the relationship between size and weight is very uniform, and also that the increase of bulk when compared with such a measurement as the breadth of the carapace becomes more and more intensified. From this Chart I have been enabled to express approximately the growth with regard to weight in Table IV.

TABLE IV.—*Carcinus mænas*.

Age.	Approx. No. of Ecdyses.	Size. Mean.	Size. Variation.	Mean Size in Inches.	Proportional Rate of Increase in Size.	Approx. Weight.	Proportional Rate of Increase in Weight
		mm.	mm.			Grammes	
3 months ...	...	2·5	1 to 4	$\frac{1}{10}$	...	...	...
6	...	4	2 to 6	$\frac{1}{6}$	...	...	...
9	...	6	3 to 9	$\frac{1}{4}$	...	...	...
1 year ...	12 15	9	4 to 14	$\frac{1}{3}$	800	1·5	?
1 year 3 mos.	...	15	10 to 20	$\frac{2}{3}$	...	...	...
1 .. 6 ..	...	25	15 to 35	1	...	...	...
1 .. 9 ..	...	32	20 to 44	$1\frac{1}{4}$	...	...	...
2 years ...	6 7	37	24 to 50	$1\frac{1}{2}$	300	12	700
3 years ..	1, 2 or 3	55	42 to 68	$2\frac{1}{3}$	50	40	230
4 years ...	1 or 0	69	55 to 83	$2\frac{3}{4}$	25	90	125

The progress in weight will be continuous between the moulting periods, but a loss takes place at the ecdysis. This is evident from the differences in weight for a given size in the above figures (Table II.).

Sexual differentiation appears to take place perhaps at the end of the first year in the case of the first hatched, but with all at the end of the second year (April). This gives an advantage in weight to the males, but the berried females attain a greater weight for the same size.

After the age of four years I have not attempted to express the growth. It is more than likely that the limits in variation will be narrowed after that period, if not before, by the crabs in succession making their last moult—absolutely the greatest—and, sooner or later, growth in weight will cease likewise. The females will take longer to attain their final size than the males. For example, suppose a female measuring 42 mm. is impregnated, and comes into "berry" in December, she will still be in "berry" say in April, and still measure 42 mms. She will cast again, very likely once, and be impregnated a second time. She will now measure say 52 mms., and this will be her size for another year, perhaps two years. At the next casting she will measure say 65 mms, and is now 5 or 6 years old. We are justified in supposing, therefore, that the females may live to 7 or 8 years before they reach their limit in growth, and two or three years more after that has taken place.

The concluding portion of this paper with reference to the growth of the edible crab is withheld at present.

THE DECAPODA OF NORTHUMBERLAND.

By A. MEEK, M.Sc.

The following introductory list of the Decapoda simply records the most of the species which have come into my hands. I desire to express my thanks to Canon Norman for his kindness in looking over the proof and suggesting certain alterations in the specific names.

Sub. Order—*BRACHYURA.*

Stenorhynchus rostratus, L.

Common at several places on the coast, and fairly common also in deep water.

Stenorhynchus longirostris, Fabr.

Rare. One specimen from off Dunstanborough.

Inachus dorsettensis (Penn.)

From Berwick Bank, *per* G. Hastings.

Inachus dorhynchus, Leach.

From off Cullercoats and from Beadnell, *per* J. Douglas.

Hyas araneus (L.)

Common at all parts of the coast.

Hyas coaretatus, Leach.

Common from the coast and from deep water.

Cancer pagurus, L.

The common edible crab is fortunately a very common inhabitant of the water near the coast. It is most abundant in the northern half of Northumberland.

Carcinus mœnas (Penn.)

The "green" or "shore" crab—often in Northumberland called the "dogger"—is very common between tide marks and close to the rocks.

Portunus puber (L.)

The velvet crab is not uncommon near the Longstone, and is sometimes procured also at other of the outlying Farnes.

Portunus holsatus, Fab.

Common on sandy ground all along the coast. A small male was obtained in July, 1901, from 59 fathoms, and in 1902 a small female from 43 fathoms. This must be the species recorded by Embleton as common in Embleton Bay.

Portunus pusillus, Leach.

Fairly common 3-4 miles off Cullercoats.

Pinnotheres pisum (Penn.)

Obtained from mussel at Blyth. A male was got 4 miles off Seaham, 29th September, 1897. It was also obtained at Druridge Bay, 8th September, 1896.

Ebalia tuberosa, Penn.

Got frequently in the deeper water from 4 to 30 miles off the coast.

Atelecyclus heterodon, Leach.

From Berwick Bank, 12th September, 1898, *per* G. Hastings. It is obtained frequently at the excursions of the Northumberland Coast Club in from 20-30 fathoms off Cullercoats.

Corystes cassivelaunus (Penn.)

Sometimes occur in the bays in great numbers during the summer. *Vide* the reports on the trawling experiments.

Sub. Order—*MACRURA*.

Lithodes maia, L.

Fairly common in moderate depths off the coast of Northumberland.

Eupagurus bernhardus (L.)

Common from the coast to the deeper water of the North Sea.

Eupagurus pubescens (Kröyer).

Common from deep water; associated with Epizoanthus.

Anapagurus laevis (Thompson).

From 59 fathoms; also with Epizoanthus.

Porcellana platycheles (Pennant).

Common at Cullercoats and other rocky parts of the coast of Northumberland.

Porcellana longicornis (L.)

Common at Cullercoats and elsewhere on coast of Northumberland. A specimen from 4 miles off Seaham, 9th September, 1897.

Galathea squamifera, Leach.

Common.

Galathea strigosa, Fabricius.

Common.

Galathea nexa, Embleton.

Got at Skate Roads on two occasions.

Galathea dispersa, Spence Bate.

Specimens procured from trawlers.

Galathea intermedia, Lilljeborg.

Specimens from deep water by trawlers.

Munida rugosa, Fabricius.

A splendid male specimen from near St. Mary's Island (caught in crab pot), 28th April, 1900.

Homarus vulgaris, M. Edwd.

The lobster is very common on the rocky parts of the coast.

Nephrops norvegicus, Leach.

The Norway lobster, commonly called in Northumberland the "prawn," is very common in the deeper water off the coast, and large quantities are brought to Shields market by trawlers. It occurs on "soft" ground, and the mud deposited by the dredgers has attracted it to three miles from the mouth of the Tyne.

Crangon vulgaris (L.)

The shrimp is fairly common in Cullercoats harbour, in the harbour at Holy Island, and elsewhere on the coast.

Crangon neglectus, G. O. Sars.

Canon Norman has examined the specimens I described as occurring at the bottom of sandy bays along with certain amphipods in my list of last year, and which I called *Crangon fasciatus*, and he pronounces them to be *C. neglectus* in a young condition.

Crangon allmani, Kinahan.

Specimens have been obtained by Dr. Brady in 20 to 40 fathoms off the Durham coast.

Spirontocaris securifrons, Norman.

A young specimen from 59 fathoms off the coast of Northumberland.

Spirontocaris cranchii (Leach).

Specimens from Druridge Bay and Cullercoats.

Hippolyte varians, Leach.

Common amongst the Laminaria, &c., all along the coast. One specimen from 27 fathoms, 120 miles E.N.E., got 13th September, 1899, by Mr. Hastings, had the typical rostrum, but the latter was rather longer than the antennules, and the internal filament of the antennule was a third longer than the external.

Pandalus montagui, Leach.

Common from the deeper water off the coast of Northumberland.

Leander squilla (Fabricius).

Specimens from Beadnell, 23rd June, 1900, *per* J. Douglas.

THE

MARINE AMPHIPODA OF NORTHUMBERLAND.

By ALEXANDER MEEK, M.Sc.

I can now add the following species to the list published in last year's report :—

Family—*Lysianassidæ*.

Tryphosella hörringii (Boeck).
Cullercoats, 13th September, 1900, near to the rocks.

Tryphosa nanoides (Lilljeborg).
39 fathoms, 1901.

Tryphosa nana (Kröyer).
30 fathoms, 1901.

Family—*Ampeliscidæ*.

Ampelisca tenuicornis, Lilljeborg.
Various localities, 20 to 59 fathoms, 1901.

Ampelisca assimilis, Boeck.
50 fathoms, 1901.

Byblis gaimardi (Kröyer).
59 fathoms, 1901.

Haploops tubicola, Lilljeborg.
50 fathoms, 1901.

Family—*Amphilochidæ*.

Amphilochus manudens, Bate.
39 and 50 fathoms, 1901 ; 52 fathoms, 1902.

Amphilochoides boeckii, G. O. Sars.
39 and 50 fathoms, 1901.

Gitana sarsii, Boeck.
21 fathoms, 1901.

Family—*Stenothoida*.

Stenothoe monoculoides (Montagu).
Tide marks, North Sunderland.

Metopa palmata, G. O. Sars.
30 fathoms, 1901.

Metopa nasuta, Boeck.
39 and 59 fathoms, 1901.

Family—*Œdicerida*.

Halimedon mülleri, Boeck.
Various localities, 39 fathoms, 1901.

Family—*Paramphithoida*.

Parapleustes latipes (M. Sars).
39 fathoms, 1901; 43 fathoms, 1902.

Family—*Syrrhoida*.

Tiron acanthurus, Lilljeborg.
30 fathoms, 1901; 52 fathoms, 1902.

Family—*Calliopida*.

Apherusa borealis (Boeck).
30 and 39 fathoms, 1901: also at inner Farne.

Apherusa jurinii (M. Edwards).
21 fathoms, 1901.

Guernia coalita, Norman.
Surface, during the night, 9 miles N.E. of Longstone, 1902.

Melphidippella macra (Norman).
30 and 39 fathoms, 1901.

Family—*Gammarida*.

Melita dentata (Kröyer).
50 fathoms, 1901.

Family—*Photida*.

Autonoe websteri (Bate).
39 and 50 fathoms, 1901.

Protomedia fasciata, Kröyer.
Juvenile specimens: several localities in 39 and in 50 fathoms, 1901: identified by Canon Norman.

Gammaropsis nana, G. O. Sars.
39 and 40 fathoms, 1901.

Megamphopus cornutus, Norman.

21 fathoms, 1901.

Photis reinhardi, Kröyer.

39 and 59 fathoms, 1901; 43 fathoms, 1902.

Family—*Podoceridæ*.

Podocerus pusillus, G. O. Sars.

42 to 45 fathoms, 82 miles E.N.E. from Tyne.

Family—*Corophiidæ*.

Cerapus crassicornis (Bate).

42 to 45 fathoms, 82 miles E.N.E. from Tyne.

Family—*Dulichiidæ*.

Dulichia porrecta, Bate.

39 and 59 fathoms, 1901.

Family—*Caprellidæ*.

Periambus typicus, (Kröyer).

30 and 39 fathoms, 1901.

Some other localities have been added to those recorded for the species named in the last report. These it is not intended to state at present; but a locality for one, viz., *Gammarus duebeni*, Lilljeborg, is so extraordinary that it must be mentioned. I have to thank Mr. W. E. Forster for sending me the specimens. They were taken from the water at the bottom of the Mill Pit, at Blyth, and appear to have been known as occurring there for some time. The miners call them "pit fish." This brackish water Amphipod, without doubt, must be common in the upper part of the harbour at Blyth, in the river Blyth, and it appears that they or their embryos have been carried down in the water which finds its way into the pit, along with other forms upon which they can feed.

FAUNISTIC NOTES.

THE THRASHER OR FOX SHARK (*ALOPECIAS VULPES*).

A fine male example of this shark was caught in a salmon net off Cullercoats, on the morning of the 31st July. The body measured 7 ft. 9 ins. in length, and the upper lobe of the tail was of the same length, giving a total length of 15½ ft., showing it to be a specimen of the largest size. The carcase, unfortunately, was towed out to sea by the owners one morning at daybreak, before any parts could be removed for examination, and only a hurried photograph was obtained, which is here reproduced. In this, the chief anatomical feature of the fish will be observed, viz., the enormous development of the tail. In the dull light of the impromptu tent in which it was exhibited, a detailed inspection was impossible, but I was unable to find any trace of a spiracle.

Though this shark is not rare on the south and west coasts of Britain, it is seldom captured in the North Sea. It is at least 30 years since one was landed at Cullercoats. The example in the Hancock Museum was obtained from Yarmouth.

W. H. Young.

THE LESSER FIN-BACKED WHALE OR RORQUAL.

(*BALAENOPTERA ROSTRATA*, Gray.)

On August 19th, a female lesser rorqual swam blindly to the shore at Druridge Bay and was stranded. I had the opportunity of visiting it the next day. A fisherman informed me that when the whale found herself stranded, she struggled fiercely, making the water and sand fly in all directions around her. She died as the tide receded from her. The carcase was bought by a local farmer, and he had already made some progress in cutting it up. It was possible, however, to make certain measurements: length, about 30 feet: greatest depth, about 5 feet; each fluke of the tail measured 3 feet 5 inches; posterior edge of small dorsal fin 8 feet from the posterior end of the body, and this edge was immediately vertical to the anal opening; the dorsal fin had been removed, but I was told it was about 7 inches high; the pectoral fin had also been removed (it was said to be about 2½ feet long), but its anterior border was 3 feet behind the mouth, and the extent of the latter measured along the lower jaw was 5 feet. The eye on the side which was exposed to

view—the right side—was greatly injured, and the injury more than likely preceded, and may have caused the stranding. The eye was situated just above the angle between the upper and the lower jaws. The blow-hole was 4 feet from the anterior end of the head. The whalebone on the exposed side had already been almost completely cut away.

The longitudinal folds on the underside of the throat commenced just behind the gape, where they measured 9 inches, and now gradually now rapidly increased in length, reaching a maximum of about 10 feet in the mid ventral line. The colour was greyish black above, passing into white below. A band of the dorsal colour passed round the body just in front of the tail. The upper side of the tail was of the same colour as the back, but beneath it was white, with varying patches of a light slaty colour. I had no chance of seeing whether the characteristic white band of the pectoral fin was present or not. The mid ventral line of the body between the anal opening and the tail was produced into a keel-like edge.

What was remarkable about the specimen was the fact, that the mouth was distended by what certainly appeared to be the everted stomach. On reflection, this apparently impossible feat in a mammal, led me to write to certain authorities on the Cetacea, but they could give me no information on the point. The only other record of a similar occurrence, of which I know, is that by Quoy and Gaimard in the case of the Great Northern Rorqual. Two days after this whale was killed, the mouth became distended by a 'bladder' which prevented the closing of the jaws. Dr. Hamilton explained the formation of this 'bladder' as being due to the accumulation of "gas generated by decomposition, and collected in the loose cellular membrane of the lower jaw." If this be the case it is certainly a remarkable effect of such a process, and in the case of the specimen of which I now write, it must have occurred very rapidly, for I saw it within a day of its death. And, in reply to an enquiry of mine, Mr. J. W. Davis, of the Coast Guard at Cresswell, informed me that he saw this distension, and its cause on the day the whale went ashore. Mr. Davis also stated that the structure was still present when the head was removed, and was of the opinion that it was not the stomach. The stomach, however, was not seen, or if seen not recognised. I think at present, it must be left at that, but I am very sorry that circumstances prevented me from being present at the cutting up of the carcase.

A. Meek.

THE BASS (Labrax lupus).

A good specimen of the Bass, 13½ inches in length, was caught on March 7th, along with a few plaice on a line near the rocks at the south end of the Tynemouth sands.

A. Meek.

ALITTA VIRENS (M. Sars).

A specimen of this Polychæt was sent on February 8th by Mr. John S. Wood, Bill Quay—about seven miles from the mouth of the Tyne. It was found alive in the shipyard about 18 months before, after an exceptionally high tide. Mr. Wood said that when it was crawling about it stretched itself to 3 feet in length. Preserved, it measures about 18 inches. I beg to thank Prof. McIntosh, St. Andrews, for his kindness in confirming my determination of the species. Since this specimen was obtained, Mr. E. P. Witten, B.Sc., got another at Sunderland which measures about 10 inches, preserved.

A. Meek.